

# CONTRIBUTIONS TO THE MOSQUITO FAUNA OF SOUTHEAST ASIA. XIV.

## THE SUBGENUS *STEGOMYIA* OF *Aedes* IN SOUTHEAST ASIA<sup>1</sup>

### I - THE *SCUTELLARIS* GROUP OF SPECIES

By

Yiau-Min Huang<sup>2</sup>

#### INTRODUCTION

The *Aedes scutellaris* group of species is the most dominant and complex in the subgenus *Stegomyia* as shown by the number of species and the variety of types. It has not been studied as a unit since Edwards (1932) and sound revision of the entire group is badly needed.

In Southeast Asia the group is comparatively poorly known, the only extensive study previously made in the Oriental region being that of Barraud (1934). In fact, Barraud's work was restricted to India which is the western part of the Oriental region and is not in the SEAMP area. More recently the faunae of individual islands have been examined by Bohart & Ingram (1946b) for Okinawa and by Knight & Hull (1952) for the Philippine Islands.

Inadequate material and insufficient descriptions in the past have led to confusion and misidentification in this area, as pointed out by Huang (1968).

In order to clarify the situation and in view of the present day interest in the subgenus, because of its medical importance, it has been decided to give a detailed description of all species and the present review is the first of a series which it is hoped will eventually complete the task. Subgeneric characters and classification of the species groups will be discussed in a final paper.

The present paper deals with 16 species of the *scutellaris* group of which 12 are definitely known to occur in the Southeast Asia area, 1 species may occur and 3 others, which are unlikely to be found, are treated here for comparison.

This study has been based primarily on specimens accumulated by the Southeast Asia Mosquito Project. Additional material was borrowed from the following institutions: Bernice P. Bishop Museum; United States National Museum; Field Museum of Natural History; University of Utah; Cornell University; Johns Hopkins School of Hygiene and Tropical Medicine; California Academy of Science; Academy of Natural Science, Philadelphia; Medical Zoology Laboratory, Institute for Infectious Disease, University of Tokyo; British Museum (Natural History) and the Instituut voor Tropische Hygiene, Amsterdam.

All the type specimens of the included species which are in the British Museum (Natural History), the United States National Museum and the Medical Zoology Laboratory, Institute for Infectious Diseases, University of Tokyo have been seen and studied by me.

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The nomenclature chosen for the chaetotaxy of the larva and pupa and the terminology of structural parts of the adult as used in this paper largely follows that of Belkin (1962) with subsequent modification by SEAMP.

An asterisk (\*) following the abbreviations used ( $\sigma$  = male,  $\varphi$  = female, P = pupa, L = larva and E = egg) indicates that all or some portion of that sex or stage is illustrated. Abbreviations used for the references to the literature conform to the World List of Scientific Periodicals, 3rd ed., Academic Press, 1952.

Distribution records are indicated as follows: Country names are in capital letters, where known, administrative divisions are in italics and place names have the first letter capitalized. Place names which could not be located in the Gazetteers available are spelled according to the labels on the specimens and are placed within inverted commas. l = larval skin, p = pupal skin, L = whole 4th instar larva.

The information on the breeding habitats and the distribution presented in this paper are entirely based on the specimens which have been examined by me.

All the known stages of the 16 species of the *scutellaris* group from Southeast Asia and its adjacent areas are redescribed and illustrated and a number of previously unknown stages are described for the first time. The Philippine species previously described as *scutellaris* (Walker) is redescribed here under a new name and 3 subspecies are elevated to species rank. Several species are recorded for the first time from particular territories. Keys to the identification of the species are provided. The information on the present status of the *scutellaris* group in Southeast Asia and its distribution are summarized in appendices I and II.

The term "Southeast Asia" as used in this review does not exactly correspond to any of the world mosquito faunal areas as defined by Belkin (1962). It comprises the following area: The Ryukyu Islands (Amami, Okinawa, Miyako, Ishigaki, Iriomote), Taiwan, The Pescadores, Hainan, China (South of the Yangtze Kiang), The Philippines, North Vietnam, South Vietnam, Indonesia (the eastern boundary is essentially that of Lee & Woodhill (1944) as shown in Lee's Atlas of Mosquito Larvae), Cambodia, Laos, Thailand, Malaysia, The Andaman Islands, The Nicobar Islands, Burma and Assam. This area falls approximately within 11 degrees South to 27 degrees North Latitude and 87 to 130 degrees East Longitude (MAP I).

Bangladesh (East Pakistan) has not been included in this review because of the total lack of material in all collections.

In order to verify distributional records, all available specimens, even if from beyond the confines of Southeast Asia, have been examined, as may be seen in the case of *albopictus* (MAP II).

## THE *Aedes* (*Stegomyia*) *scutellaris* GROUP IN SOUTHEAST ASIA

**DEFINITION OF THE GROUP.** The Southeast Asia *scutellaris* group is characterized by the following combination of characters.

**MALE. Head.** Proboscis dark scaled, with or without pale scales on ventral side, as long as or longer than fore femur; palpus dark, slightly shorter to longer than proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, slightly to considerably shorter than proboscis; clypeus bare; torus covered with white scales except on dorsal side; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with median stripe of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally. **Thorax.** Scutum with narrow dark scales and a

prominent median stripe of similar white ones; the median stripe usually narrows slightly posteriorly and forks at beginning of prescutellar space; sometimes this median stripe is broken at middle of scutum and is followed by an inverted Y-shaped marking which forks at beginning of prescutellar space; there is on each side a posterior dorsocentral line of narrow white to yellowish scales which does not reach to middle of scutum and an incomplete, not clearly defined, to complete and well developed supraalar white line; with or without a few narrow white scales on various areas of scutum; acrostichal bristles absent; dorsocentral bristles present; scutellum with broad white scales on all lobes and with a few broad dark ones at apex of mid lobe; anterior pronotum with broad white scales; posterior pronotum with a patch or a stripe of broad white scales and some dark narrow ones dorsally; paratergite with broad white scales; postspiracular area with or without scales; subspiracular area with or without scales; patches of broad white scales on propleuron, on upper and lower portions of sternopleuron and on upper and lower portions of mesepimeron; mesepimeral scale patches connected or separated; lower mesepimeron without bristles; metameron bare. *Wing*. With dark scales on all veins, with or without a minute basal spot of white scales on costa. *Halter*. With dark scales.<sup>1</sup> *Legs*. Coxae with patches of white scales; knee-spots present on all femora; fore and mid femora dark, with or without pale scales scattered anteriorly, paler posteriorly; sometimes mid femur with a median white line on anterior surface; hind femur anteriorly with a broad white longitudinal stripe which widens at base and is separated from apical white scale patch; fore and mid tibiae dark anteriorly, paler posteriorly; hind tibia dark; fore and mid tarsi with basal white bands on tarsomeres 1-3; hind tarsus with basal white bands on tarsomeres 1-4, tarsomere 5 all white,<sup>2</sup> or sometimes with a few dark scales at tip on ventral side; fore and mid legs with tarsal claws unequal, larger one toothed, smaller one simple; hind leg with tarsal claws equal, simple. *Abdomen*. Abdominal segment I with white scales on laterotergite; tergum I with or without a median patch of white scales; terga II-VI with lateral white spots only or with complete or incomplete transverse white basal or sub-basal bands as well; lateral spots may be connected or not with the dorsal bands; tergum VII with lateral white spots only; sterna I-VI with basal white bands to all white; sternum VIII largely to entirely covered with white scales. *Terminalia*. Basimere 2 to 3.5 times as long as wide; its scales restricted to dorsolateral, lateral and ventral areas; with few to a patch of hairs on the basomesal area of dorsal surface; mesal surface membranous; claspette well developed, with numerous setae and some specialized ones; distimere simple, elongate, 0.75 to as long as basimere, with a spiniform process at apex to some distance from the tip and with a few hairs; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct without teeth; cercal setae absent; ninth tergum in middle rounded, truncated, or produced into a lobe or a median projection with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 4-segmented, short, 0.2 of proboscis, with white scales on apical half or more. Fore and mid legs with tarsal claws equal, simple. Abdominal segment VIII largely to entirely retracted; sternum VIII with conspicuous rounded lateral lobe; post-genital plate with shallow notch; cerci short and broad; 3 spermathecae, 1 larger than other 2.

<sup>1</sup> *A. flavopictus*, a Palearctic species has pale scales in this position.

<sup>2</sup> One species (*nensilli*) which does not occur in Southeast Asia has the apical half of tarsomere 5 dark.



**PUPA.** *Cephalothorax*. Trumpet short, 3 to 3.5 times as long as wide at the middle; hair 1,3-C single, longer than 2-C; 6-C single, stout, stouter than 7-C; hair 10-C with 2-5 branches, mesad and caudad of 11-C; 11-C single. *Abdomen*. Hair 1-I well developed, with more than 10 branches, dendritic; hair 2-I single; hair 3-I single, long; hair 2,3-I not widely separated, distance between them as distance between 4,5-I; hair 1-II branched; hair 2-IV-V mesad of hair 1. *Faddle*. Margins with fringe; apex rounded or produced; hair 1-P single.

**LARVA.** *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; hair 5,8,9,13-C single; mentum with 9-14 teeth on each side. *Thorax*. Hair 2,6-P single; 5,7-M single; 6-M with 2-4 branches; 9-M with 2-3 branches; 9-T with 2-3 branches. *Abdomen*. Comb of 6-14 scales, in a single row, each scale with strong or fine denticles or a delicate fringe at base of apical spine; pentad hair 2-VIII distant from 1-VIII; 2,4-VIII single; siphon short, less than 2 to 2.5 times as long as wide, acus absent or small; pecten teeth 3-21 in number, evenly spaced, each tooth with 1-4 distinct basal denticles; 1-S with 2-5 branches, inserted beyond last tooth; saddle incomplete or complete; marginal spicules very small and inconspicuous; 3-X single; ventral brush with 4 pairs of hairs on grid, 4a-X and 4b-X single, 4c-X and 4d-X with 1-2 branches; without precratal tufts; anal papillae varied.

**DISTRIBUTION.** The Southeast Asia *scutellaris* group is mainly confined to the Oriental and Indomalayan areas, with extensions into the southern part of the Palearctic and the western part of the Papuan area. *Aedes* (*Stegomyia*) *albopictus* (Skuse) is also known in the Malagasy area, the Bonin Islands, the Mariana Islands and the Hawaiian Islands.

**TAXONOMIC DISCUSSION.** The group has been differently interpreted. Edwards (1932) divided the subgenus *Stegomyia* into four groups which he designated A, B, C and D. In "Group C (*scutellaris* group)" he included 10 species from the Oriental and Australasian regions, Crete and Africa. Knight & Rozeboom (1946) removed *A. albolineatus* (Theobald) from Group C and defined a fifth group for it and its relatives and this was designated Group E (*albolineatus* group) by Knight & Hurlbut (1949). The latter authors subdivided the *scutellaris* group into 3 subgroups known as Subgroup I. *scutellaris* s. str., Subgroup II. *albopictus* and Subgroup III. *mediopunctatus*. Mattingly (1965) transferred *mediopunctatus* from Group C to Group B. The term "the *scutellaris* group" as used by Farner & Bohart (1945) and others has, in fact, referred to practically the same complex of species as Knight & Hurlbut's Subgroup I. The *scutellaris* group of the present paper comprises both Knight & Hurlbut's Subgroups I. and II.

At the present, 12 species of the *scutellaris* group are found within the Southeast Asia area and 1 additional species may also be present. In addition, there is one form of *scutellaris* known but not named from Andaman Islands (Barraud 1928, 1934). This awaits review when more adequate material is available.

The Southeast Asian *scutellaris* group can be divided further into 2 subgroups, the *albopictus* subgroup and the *scutellaris* subgroup. (1) The *albopictus* subgroup is characterized by having the supraalar white line not clearly defined and with only narrow scales over the wing root. It is represented by 6 species, *albopictus* (Skuse), *downsi* Bohart & Ingram, *novalbopictus* Barraud, *patriciae* Mattingly, *pseudalbopictus* (Borel) and *seatoi* Huang. Included also in this subgroup is 1 Oriental species, *subalbopictus* Barraud from India, which may eventually be found in Southeast Asia. It has been recorded from Hainan Island by Stone, Knight & Starcke (1959), but I have seen no specimens. In addition, 1 Palearctic species, *flavopictus* Yamada from Japan and Korea, which is not found in Southeast Asia is treated here for comparison. (2) The *scutellaris* subgroup is characterized by

having the supraalar white line complete and well developed, with broad flat scales over the wing root and toward scutellum. It is represented by 6 species, *alcasidi* n. sp., *alorensis* Bonne-Wepster, *andrewsi* Edwards, *malayensis* Colless, *paullusi* Stone & Farner and *riversi* Bohart & Ingram. Included also in this subgroup is 1 western Pacific island species, *hensilli* Farner from Ulithi Island, W. Carolines and 1 Papuan species, *scutellaris* (Walker) from Aru (Aroe) Islands, Ceram, Ambon Island and New Guinea. These 2 species are not found in Southeast Asia and are treated here for comparison.

Based on the present collection data, all the members of the *albopictus* subgroup in Southeast Asia occur in the Oriental area of Belkin (1962). *A. albopictus* has the widest distribution throughout the entire Southeast Asia area and beyond, as shown in MAP II, and *pseudalbopictus* is also known to occur in the Indomalayan area (Malaya and Java). All members of the *scutellaris* subgroup, except *riversi* from the Oriental area, are Indomalayan in distribution. *A. malayensis* is also known to occur in the Oriental area (Thailand, Cambodia, Vietnam and Taiwan) and *paullusi* extends into the western fringe of the Papuan area (Ambon I.).

The pupae and larvae do not seem to have subgroup characters. The larvae of *albopictus* proper are extremely similar to and difficult to separate from those of *alcasidi*, *malayensis*, *riversi* and *scutellaris* which are in a different subgroup. This indicates that the two subgroups are closely related and should be recognized under one species group, the *scutellaris* group.

In the identification of the species of the *scutellaris* group, the adult stages appear to be more promising than the immature stages. However, it must be remembered that specific differences between the members of this group tend to be very slight. Some members are highly variable in both adult ornamentation and in the immature stages. Although the males of all species can be recognized on the basis of morphological features, the females and the immatures are extremely difficult or impossible to distinguish in many instances. The male terminalia of all species are distinct and the most diagnostic feature of all is the claspette of the basimere. In dealing with these, special preparations must be made and care taken to study both lateral and mesal views of the dissected claspette as well as undissected views.

It is now difficult and sometimes impossible to say what former workers were dealing with when they called a species "*albopictus*". This applies especially in the case of larvae of the different species which this review will show are so closely related that misidentification has probably largely been the rule. The fact that so many species of the group are known to share the same habitat adds considerably to the problem. Surveys based on the identification of a single larvae obviously lend themselves to criticism on this account.

**BIOLOGY.** The immature stages have been found mainly in tree holes, bamboo stumps, coconut shells and artificial containers. Some species have also been found in rock holes and a few have also been found in leaf axils. Females of 5 species, *albopictus*, *downsi*, *seatoi*, *riversi* and *malayensis* are known to bite man and *paullusi* has been taken biting buffalo.

**MEDICAL IMPORTANCE.** The *scutellaris* group is one of the most important groups of *Stegomyia* from the standpoint of transmission of pathogens. *A. albopictus* is an important vector of dengue virus in Southeast Asia. It has been incriminated in the transmission of dengue virus during an outbreak of hemorrhagic fever in Singapore (Chan et al., 1971) and dengue virus has been isolated from wild-caught *albopictus* from Koh Samui, Thailand (Gould et al., 1968, 1970). *A. albopictus* from India can transmit chikungunya virus in the laboratory (Rao et al., 1964) and *scutellaris* from New Guinea has been incriminated as a vector of dengue virus (Mackerras, 1946). Some members of the *scutellaris* group are efficient vectors of non-periodic filariasis in the South Pacific (Belkin, 1962), and 3rd stage larvae of *Dirofilaria* spp. have

been found in *albopictus* in Thailand (Harinasuta et al., 1970). The part played by *albopictus* in the transmission of pathogens is summarized in Table I (page 18).

#### KEYS TO THE SPECIES DEALT WITH IN THIS REVIEW

The *scutellaris* group of species, including those not so far recorded from Southeast Asia, can be distinguished from other *Stegomyia* by the following combination of characters: palpi with white scales; scutum with a long median longitudinal white stripe extending from anterior margin to about level of wing root; scutellum with broad white scales on all lobes; hind tarsus with basal white bands on tarsomeres 1-4, tarsomere 5 with basal white band or all white.

#### MALES AND FEMALES

1. Supraalar white line incomplete, not clearly defined and with only narrow scales over wing root . . . . . 2
- Supraalar white line complete and well developed, with broad flat scales over wing root and toward scutellum (Fig. 21A) . . . . . 9
- 2(1). Scutum with patch of broad flat white scales on lateral margin just before level of wing root (Fig. 1D) . . . . . 3
- Scutum without such patch . . . . . 4
- 3(2). Scutum with small white patch of narrow scales at scutal angle; tergum I with a large median patch of white scales (Figs. 15A, B, C) . . . . . *seatoi* Huang
- Scutum and tergum I without such patches of scales (Figs. 1A, B, D) . . . . . *albopictus* (Skuse)
- 4(2). Scutum with patch of narrow curved yellowish scales on lateral margin just before level of wing root . . . . . 5
- These scales white . . . . . 8
- 5(4). Fore and mid femora with some pale scales scattered on anterior surface . . . . . *novalbopictus* Barraud
- Fore and mid femora without such scales . . . . . 6
- 6(5). Subspiracular area with scales; hind femur anteriorly with broad white longitudinal stripe which widens at base and occupies at least basal 3/4; hind tarsomere 4 with at most basal 2/3-3/4 white banded (Figs. 20M, O) . . . . . 7
- Subspiracular area without scales; white longitudinal stripe confined to basal 3/5 of femur; hind tarsomere 4 with basal 5/6-9/10 white banded (Fig. 20N) . . . . . *downsi* Bohart & Ingram

- 7(6). Scutum with patch of narrow curved golden yellowish scales on lateral margin just before level of wing root; halter with pale scales . . . . . *flavopictus* Yamada<sup>1</sup>  
 These scutal scales pale yellowish; halter without pale scales . . . . . *patriciae* Mattingly
- 8(4). Scutum with patch of broad dark scales on each side of prescutellar space between prescutellar white line and postdorso-central white line; postspiracular area with scales (Figs. 20C, I) . . . . . *pseudalbopictus* (Borel)  
 Scutum without such patch of scales; postspiracular area without scales (Fig. 20A) . . . . . *subalbopictus* Barraud
- 9(1). Abdomen with lunate lateral white spots only; wing without a minute basal spot of white scales on costa (Fig. 20D) . . . . . *andrewsi* Edwards  
 Abdomen with some complete pale bands or with indications of such bands on terga; wing with a minute basal spot of white scales on costa . . . . . 10
- 10(9). Mid femur with a median white line on anterior surface (Fig. 20K) . . . . . 11  
 Mid femur without such line . . . . . 12
- 11(10). Scutum with a few narrow white scales on lateral prescutal area and on scutal angle area (Fig. 20J) . . . . . *paullusi* Stone & Farner  
 Scutum without any narrow white scales in these positions . . . . . *alorensis* Bonne-Wepster
- 12(10). Hind tarsomere 5 all white . . . . . 13  
 Hind tarsomere 5 with basal 1/2 white (Fig. 31C) . . . . . *hensilli* Farner<sup>2</sup>
- 13(12). Hind tarsomere 3 with basal 2/5 white; hind tarsomere 4 with basal 2/3 white . . . . . 14  
 Hind tarsomere 3 with basal 1/2 white; hind tarsomere 4 with basal 3/4 white (Fig. 21E) . . . . . *alcasidi* n. sp.  
 (Fig. 31F) . . . . . *scutellaris* (Walker)
- 14(13). Hind tarsomere 1 with basal 1/4 white; hind tarsomere 2 with basal 1/3 white (Fig. 31D) . . . . . *malayensis* Colless  
 Hind tarsomere 1 with basal 1/5 white; hind tarsomere 2 with basal 1/4 white (Fig. 31E) . . . . . *riversi* Bohart & Ingram

The female of *novalbopictus* Barraud is unknown.

<sup>1</sup> Palearctic species.

<sup>2</sup> Western Pacific species.

## MALE TERMINALIA

- |   |                                |
|---|--------------------------------|
| 1. Tergum IX with a median lobe or projection . . . . .   | 2                              |
| Tergum IX with middle broadly rounded or truncated . . . . .  | 8                              |
| 2(1). Tergum IX with conspicuous horn-like median projection (Fig. 2C) . . . . .  | <i>albopictus</i> (Skuse)      |
| Tergum IX with middle part produced into a lobe . . . . .   | 3                              |
| 3(2). Tergum IX with middle part produced into large lobe with apex serrated . . . . .  | 4                              |
| Apex of lobe not serrated . . . . .   | 5                              |
| 4(3). Basimere 2.5 times as long as wide; claspette large, apical angle reaching to 0.8 of basimere; claspette with stem at base and lateral arms rather slender in lateral aspect (dissected claspette) (Figs. 4C, 8B) . . . . . | <i>downsi</i> Bohart & Ingram  |
| Basimere 3 times as long as wide; claspette large, fan-shaped, apical angle reaching to 0.75 of basimere; claspette with stem at base and lateral arms widened in lateral aspect (dissected) (Figs. 6C, 8A) . . . . .             | <i>flavopictus</i> Yamada      |
| 5(3). Tergum IX with large median lobe; claspette long, slender, reaching to 0.75 of basimere, expanded portion facing mesad (Fig. 16C) . . . . .   | <i>seatoi</i> Huang            |
| Tergum IX with rounded median lobe; claspette large, broad, reaching to about 0.5 of basimere, expanded portion horizontal in position . . . . .  | 6                              |
| 6(5). Specialized setae on sternal side of expanded portion of claspette spine-like, curved, with sharply pointed tips and varying lengths (Figs. 9C, 8C) . . . . .   | <i>novalbopictus</i> Barraud   |
| These setae blade-like or clubbed, without sharply pointed tips . . . . .   | 7                              |
| 7(6). Claspette with broad stem and lateral distal angle turned through 90° in lateral aspect (dissected) (Fig. 18C) . . . . .  | <i>subalbopictus</i> Barraud   |
| Claspette with narrower stem and without a 90° lateral distal angle (Fig. 11C) . . . . .  | <i>patriciae</i> Mattingly     |
| 8(1). Claspette complex with numerous setae on expanded distal part, each seta on distinct cone, a tergal mesal finger-like process bearing 6 modified setae at tip (Fig. 24B) . . . . .  | <i>alorensis</i> Bonne-Wepster |
| Claspette simple . . . . .  | 9                              |

- 9(8). Tergum IX with middle truncated;  
 claspette truncate, with a distinct  
 oval face at apex, with numerous  
 setae and several long, stout ones  
 on tergal side and with 4 spine-like  
 setae on sternal side of oval face  
 (Fig. 29C) . . . . . *paullusi* Stone & Farner
- Tergum IX with middle rounded;  
 claspette with apex more or less  
 cylindrical . . . . . 10
- 10(9). Claspette long, slender, reaching to  
 0.7 of basimere, with 1 widened  
 specialized spine-like seta and nu-  
 merous setae distal to it (Fig. 13C). . . . . *pseudalbopictus* (Borel)
- Claspette rather short, with several  
 widened specialized setae and nu-  
 merous setae . . . . . 11
- 11(10). Claspette with distal expanded part  
 square in lateral aspect (dissected),  
 sternal and tergal sides more or  
 less parallel, apicosternal angle  
 present . . . . . 12
- Claspette with distal expanded part sub-  
 triangular in shape in lateral aspect  
 (dissected), sternal and tergal sides  
 not parallel but tapering, without apico-  
 sternal angle . . . . . 13
- 12(11). Claspette with 4-5 modified setae in a  
 row on apicosternal angle, with several  
 distinctly long and stout setae in apico-  
 tergal area (Fig. 24A) . . . . . *andrewsi* Edwards
- Claspette with 5-6 modified setae set on a pro-  
 minence close to apicosternal angle area,  
 without any distinctly long and stout setae in  
 apicotergal area (Figs. 35C, 25A, B) . . . . . *scutellaris* (Walker)
- 13(11). Apicotergal area of claspette with several  
 distinctly long setae . . . . . 14
- Apicotergal area without any such setae . . . . . 15
- 14(13). Claspette with 6-7 modified setae in a row  
 at center of sternal side and occupying  
 about 1/3 of it (Figs. 22C, 26C) . . . . . *alcasidi* n. sp.
- Claspette usually with 7 modified setae,  
 basal one often rather smaller, in a  
 row, set on a slight prominence at  
 center of sternal side and occupying  
 about 2/5 of it (Figs. 25C, D, E) . . . . . *hensilli* Farner
- 15(13). Claspette with 7-10 modified setae forming  
 a prominent row at center of sternal  
 side and occupying about 1/2 of it  
 (Figs. 26D, 27C) . . . . . *malayensis* Colless

- Claspette with 6-8 modified setae at center of sternal side, closer to sternal angle area than to apicotergal angle area and occupying about 2/5 of it (Figs. 26A, B, 32C) . . . . . *riversi* Bohart & Ingram

## PUPAE

1. Hair 9-III-V strongly developed, thickened, much stouter than 9-II (Figs. 16A, B) . . . . . *seatoi* Huang  
 Hair 9-III-V not strongly developed, slender, about same magnitude as 9-II . . . . . 2
- 2(1). Hair 9-VI much stouter than 9-V, at least twice as long as 9-V . . . . . 3  
 Hair 9-VI about as thick as 9-V, less than twice as long as 9-V . . . . . 4
- 3(2). Hair 9-VI usually single and barbed; 9-VII usually single and barbed or with 2 branches at tip; 9-VIII usually with 2 main stems (1-2) reaching beyond paddle fringe, each with lateral branches of varying length (Figs. 4A, B) . . . . . *downsi* Bohart & Ingram  
 Hair 9-VI single and simple; 9-VII single and barbed; 9-VIII usually with 2 main stems, barbed, not reaching beyond fringe of paddle (Figs. 18A, B) . . . . . *subalbopictus* Barraud
- 4(2). Hair 9-VII single, stout and barbed or split at tip . . . . . 5  
 Hair 9-VII single, simple . . . . . 8
- 5(4). Hair 6-C much shorter than 7-C . . . . . 6  
 Hair 6-C about as long as 7-C . . . . . 7
- 6(5). Paddle margins with rather short fringe; hair 9-VIII single, strong, barbed (Figs. 9A, B) . . . . . *novalbopictus* Barraud  
 Paddle margins with long fringe; hair 9-VIII usually with 2 main stems (1-2), each barbed, reaching beyond fringe of paddle (Figs. 6A, B) . . . . . *flavopictus* Yamada
- 7(5). Hair 6-C much stouter than 7-C and usually slightly longer; hair 1-II usually with 10-11 branches rising from a common stem at base; 9-VIII usually with 2 main stems, reaching beyond fringe of paddle, each with lateral branches of varying length; paddle margins fringed close to base, on more than apical 3/4 of paddle (Figs. 29A, B) . . . . . *paullusi* Stone & Farner

- Hair 6-C usually about as long as 7-C;  
hair 1-II branched, without a common  
stem at base; paddle margins with  
fringe on less than apical 3/4 of pad-  
dle (Figs. 22A, B) . . . . . *alcasidi* n. sp. (in part)  
(Figs. 35A, B) . . . . . *scutellaris* (Walker) (in part)
- 8(4). Hair 9-VIII usually with 2 (1-2) branches,  
each barbed, not reaching beyond fringe  
of paddle (Figs. 11A, B) . . . . . *patriciae* Mattingly  
Hair 9-VIII reaching beyond fringe of paddle . . . . . 9
- 9(8). Hair 6-C about 1/2 as long as 7-C . . . . . 10  
Hair 6-C about 3/4 the length of 7-C to  
about as long as 7-C . . . . . 11
- 10(9). Hair 9-VIII with 2 branches (Figs. 13A, B). *pseudalbopictus* (Borel)  
Hair 9-VIII usually single (1-2) (Figs.  
2A, B) . . . . . *albopictus* (Skuse)
- 11(9). Hair 6-C about 3/4 the length of 7-C . . . . . 12  
Hair 6-C about as long as 7-C  
(Figs. 22A, B) . . . . . *alcasidi* n. sp. (in part)  
(Figs. 35A, B) . . . . . *scutellaris* (Walker) (in part)
- 12(11). Hair 9-VIII usually with single main  
stem or divided into 2 and lateral  
branches of varying length; hair 1-II  
with many primary and secondary  
branches (Figs. 27A, B) . . . . . *malayensis* Colless  
Hair 9-VIII usually with 2 branches (1-2),  
barbed; hair 1-II with very few second-  
ary branches (Figs. 32A, B) . . . . . *riversi* Bohart & Ingram

## FOURTH STAGE LARVAE

1. Comb scale with prominent denticles at  
base of apical spine; hair 2-VII usu-  
ally with 6 (5-8) branches (Fig. 17) . . . . . *seatoi* Huang  
Comb scale without such denticles . . . . . 2
- 2(1). Siphon acus present; pecten teeth 3-6,  
each tooth short and stout; usually  
with 3-4 basal denticles (Fig. 14). . . *pseudalbopictus* (Borel)  
Siphon acus absent; at least 8 pecten  
teeth, each tooth long, at least 4  
times as long as wide . . . . . 3
- 3(2). Saddle complete . . . . . 4  
Saddle incomplete . . . . . 6
- 4(3). Hair 14-P with 5-7 branches; hair 2-VII  
with 4-5 branches; comb scale and  
pecten tooth rather narrow and slender,  
with sharply pointed tips (Fig. 7) . . . . . *flavopictus* Yamada  
Hair 14-P with 2-3 branches; hair 2-VII  
with 2-3 branches; comb scale and  
pecten tooth rather broad and stout . . . . . 5



- 5(4). Hair 2-X 2-branched; pecten teeth each usually with 3 (2-3) basal denticles; 1-S inserted beyond last tooth and ventrad of teeth (Fig. 10) . . . . . *novalbopictus* Barraud
- Hair 2-X usually single, when 2-branched one much smaller than the other; pecten tooth usually with 2 (2-3) basal denticles; 1-S inserted well beyond last tooth and in line with teeth (Fig. 19) . . . *subalbopictus* Barraud
- 6(3). Hair 2-X 3-branched; hair 2-VII usually with 3 (2-3) branches; pecten tooth with 1 large and occasionally 1-2 very small basal denticles (Fig. 30) . . . *paullusi* Stone & Farner
- Hair 2-X 2-branched . . . . . 7
- 7(6). Hair 1-VII usually with 4 (3-4) branches, short, less than twice as long as 5-VII . . . . . 8
- Hair 1-VII usually with 2 (2-3) branches, long, at least 2.5 times as long as 5-VII . . . . . 10
- 8(7). Hair 2-VII with 3-4 branches . . . . . 9
- Hair 2-VII usually single (1-2) (Fig. 3) . . . . . *albopictus* (Skuse)
- 9(8). Comb scale with free portion widened at base and sharply pointed at tip (Fig. 5) . . . . . *downsi* Bohart & Ingram
- Comb scale with free portion rather slender, nearly parallel-sided from base and at least as long as attached portion (Fig. 12) . . . . . *patriciae* Mattingly
- 10(7). Hair 1-VII with 2-3 branches; siphon about twice as long as wide; pecten teeth 10-21 in number, closely arranged in a line; 1-S usually inserted beyond middle of siphon; comb scale sometimes with apical spine split at tip (Fig. 33) . . . *riversi* Bohart & Ingram
- Hair 1-VII usually with 2 long branches (2-3), when 3-branched then one much smaller than other two; siphon about 2.5 times as long as wide; pecten teeth 10-16 in number; 1-S inserted at middle or before middle of siphon . . . . . 11
- 11(10). Hair 1-S usually inserted at middle of siphon; pecten teeth 10-14 in number, each with 2-4 basal denticles (Fig. 28) . . . . . *malayensis* Colless
- Hair 1-S usually inserted before middle of siphon (Fig. 23) . . . . . *alcasidi* n. sp.
- (Fig. 36) . . . . . *scutellaris* (Walker)

*AEDES (STEGOMYIA) ALBOPICTUS* (SKUSE)

(Fig. 1, ♂; 2, ♂ terminalia, pupa; 3, larva)

- Culex albopictus* Skuse 1894, Indian Mus. Notes 3(5):20 (♀).  
*Stegomyia scutellaris* (Walker), Theobald 1901, Mon. Cul. 1:298 (♂\*, ♀\*);  
 Leicester 1908, Cul. Malaya 3(3):86 (♂, ♀) (misidentifications).  
*Stegomyia scutellaris samarensis* Ludlow 1903, J. N. Y. ent. Soc. 11:138  
 (♂, ♀).  
*Stegomyia lamberti* Ventrillon 1904, Paris Mus. Bull. 10:552 (♂, ♀).  
*Stegomyia nigrizia* Ludlow 1910, Canad. Ent. 42:194 (♀).  
*Stegomyia quasinigrizia* Ludlow 1911, Psyche 18:129 (♂).  
*Aedes (Stegomyia) albopictus* (Skuse), Edwards 1917, Bull. ent. Res. 7:209  
 (synonymized *samarensis*); Dyar & Shannon 1925, Insec. Inscit.  
 menst. 13:74 (synonymized *nigrizia* and *quasinigrizia*); Barraud 1931,  
 Indian J. med. Res. 19:222 (♂\*); Edwards 1932, Genera Insect., Fasc.  
 194:164 (synonymized *lamberti*); Bonne-Wepster & Brug 1932, Geneesk.  
 Tijdschr. v. Ned.-Ind. 2:73 (♂\*, L\*); Barraud 1934, Fauna Brit.  
 India 5:233 (♂\*, ♀, L\*); Bohart & Ingram 1946, U.S. Navmed. 1055:5,  
 35, 64 (♂\*, ♀\*, L\*); LaCasse & Yamaguti 1950, Mosq. Fauna Japan  
 and Korea :111 (♂\*, ♀\*, P\*, L\*); Knight & Hull 1952, Pacif. Sci. 6(2):  
 176 (♂\*, ♀, L); Bonne-Wepster 1954, Spec. Publ. R. trop. Inst.  
 Amsterdam 111:81 (♂, ♀\*, L\*); Bohart 1956, Insects Micronesia 12(1):  
 57 (♂\*, ♀, L); Hara 1957, Jap. J. exp. Med. 27:65 (♀\*); Belkin 1962,  
 Mosq. South Pacific 1:456 (♂\*, ♀, P\*, L\*); Huang 1968, Proc. ent. Soc.  
 Wash. 70(4):298 (♂\*, ♀\*, P\*; Neotype designated).

**MALE.** *Head.* Proboscis dark scaled, as long as fore femur; palpus dark, longer than proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, slightly shorter than proboscis. *Thorax.* Scutum with narrow dark scales and a prominent median stripe of similar white ones, which narrows slightly posteriorly and forks at beginning of prescutellar space; on each side a posterior dorso-central white line which does not reach to middle of scutum; a patch of broad flat white scales on lateral margin just before level of wing root and few narrow curved white scales over wing root; posterior pronotum with a large patch of broad white scales and some dark narrow ones dorsally; postspiracular area without scales; subspiracular area with white scales; mesepimeral scale patches connected forming a V-shaped white scale patch, the open end of 'V' directed backwards. *Wing.* With dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.5 times as long as its stem. *Halter.* With dark scales. *Legs.* Fore and mid femora dark anteriorly, paler posteriorly; hind femur anteriorly with a broad white stripe which widens at base and is narrowly separated from apical white scale patch; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomeres 1-4 is 1/3, 2/5, 1/2 and 2/3, tarsomere 5 all white, or sometimes with a few dark scales at tip on ventral side. *Abdomen.* Abdominal segment I with white scales on laterotergite; terga III-VI each with a basal white band which widens laterally and with lateral white spots which do not connect with the basal bands; terga II and VII with lateral white spots only, or sometimes tergum II also with a median white spot; sterna II-III largely covered with white scales; IV-VI each with a basal white band; sternum VIII largely covered with white scales. *Terminalia.* Basimere relatively short and broad, twice as long as wide; with a patch of hairs on basomesal area of dorsal surface; mesal surface extensively membranous; claspette large, mushroom-like, with numerous setae and with several widened specialized setae

on mesal side and a few widened specialized curved ones on apical angle of expanded distal part; distimere simple, elongate, apex somewhat swollen and with some hairs; with a spiniform process at apex; tergum IX with conspicuous horn-like median projection and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on apical half. Abdominal pale basal bands present on terga II-VII; segment VIII large retracted, sternum VIII with conspicuous rounded lateral lobe; post-genital plate with shallow notch; cerci short and broad; 3 spermathecae, 1 larger than other 2.

**PUPA.** *Cephalothorax.* Trumpet short, 3 times as long as width at middle; both hair 1, 3-C single, longer than 2-C; 2-C usually single (1-2); 4-C usually double (1-2); 5-C usually 3-branched (2-3); 6-C single, stout, shorter than 7-C; 7-C usually single (1-2); 10-C usually with 2-3 branches; mesad and caudad of 11-C; 11-C single. *Abdomen.* Hair 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; hair 1-II usually with 4-8 branches; 2-II laterad of 3-II; hair 2-IV, V mesad of hair 1-IV, V; hair 1-III usually with 2-3 branches (2-5); hair 3-II, III single, shorter than segment III; hair 5-IV-VI single, or sometimes 5-IV, V double, not reaching beyond posterior margin of following segment; hair 9-I-VI small, single, simple; 9-VII, VIII stouter than preceding ones; hair 9-VII single, simple; hair 9-VIII usually single (1-2), barbed, reaching beyond fringe of paddle. *Paddle.* Margins with fringe; hair 1-P single; 2-P sometimes present.

**LARVA.** *Head.* Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; inner mouth brushes pectinate at tip; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; hair 5, 8, 9, 13-C single; 6-C single or double; 10-C usually single (1-2); 7-C usually with 2-3 branches; 11-C usually 3-branched (3-4); 12-C usually double; 14-C usually with 3-4 branches; 15-C usually double (2-3); mentum with 10-12 teeth on each side. *Thorax.* Hair 1-P with 3-4 branches; 2-P single; 3-P double; 4-P usually 3-branched (2-3); 5-P usually single, rarely double; 6-P single; 7-P usually double (2-3); 9-P single; 11-P usually double (1-2); 14-P 3-branched; 5, 7-M single; 6-M usually 3-branched (3-4); 8-M with 4-5 branches; 9-M usually double, rarely 3-branched; 10, 12-M single, long stout; 11-M single, small; 7-T usually with 4-5 branches; 9-T double; 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen.* Hair 6-I usually 3-branched (2-4); 7-I single; 6-II usually 3-branched (2-3); 7-II usually 3-branched (2-3); 6-III-V double; 6-VI single; 1-VII usually 4-branched (3-4); 2-VII usually single (1-2); comb of 8-12 scales, rarely 6, in a single row, each scale with fine denticles or fringes at base of apical spine; pentad hair 2, 4-VIII single; 1-VIII with 3-5 branches; 3-VIII with 5-7 branches; 5-VIII with 3-4 branches; siphon short, about twice as long as wide, acus absent; pecten teeth 8-14 in number, evenly spaced, each tooth with 2 main basal denticles; 1-S with 2-4 branches, inserted beyond last tooth and in line with teeth; saddle incomplete; marginal spicules very small and inconspicuous; 1-X 2-branched; 2-X 2-branched, rarely single; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single; no precratal tufts; anal papillae about 3 times as long as saddle, sausage-like.

**TYPE DATA.** *Culex albopictus* Skuse, type females, non-existent; type locality: Calcutta, INDIA; *Aedes (Stegomyia) albopictus* (Skuse), Neo-type male (No. 1-14-104) with associated pupal skin and terminalia slide (68/1054), Neo-allotype female (No. 1-14-15) (designated by Y. M. Huang, 1968) in U.S. National Museum, Washington, D.C.; type locality: Botanical Garden, Calcutta, Bengal, INDIA, 3-VII-1967 (S. Ramalingam, E. D. Abraham & E. S. Abraham).

DISTRIBUTION. 12,300 specimens examined: 3,275♂, 4,284♀, 576 ♂ terminalia, 4 ♀ terminalia, 182 L; 2,364 individual rearings (1,615 l, 2,364 p).

PHILIPPINES. *Luzon*; *Leyte*; *Mindoro*; *Samar*; *Mindanao*; *Jolo*; *Culion*; *Busuanga*; *Palawan*; *Negros*; 1,015♂, 1,473♀, 55 ♂ terminalia, 655 individual rearings (465 l, 655 p).

RYUKYU ISLANDS. *Iriomote*; *Ishigaki*; *Miyako*; *Okinawa*; *Amami*; 107♂, 181♀, 8 ♂ terminalia, 184 individual rearings (184 l, 184 p).

TAIWAN. *Taipei*; *Hsin-Chu*; *Fing-tung*; *Orchid Island*; 9♂, 16♀, 1 ♂ terminalia, 14 individual rearings (14 l, 14 p).

HONG KONG. *Hong Kong*; *New Territories*: *Taipokau*; *Kowloon*; 19♂, 24♀, 2 ♂ terminalia.

CHINA. *Kwangtung*: *Kwangtung*; *Canton*; *Fukien*: *Fukien*; *Fuchow*; *Chekiang*: *Hangchow*; *Kiangsu*: *Shanghai*; *Nanking*; *Hopeh*: *Peking*; *Hainan*; 6♂, 16♀, 1 ♂ terminalia.

VIET NAM. *Con Son*; *Kontum*; *Gia Dinh*: *Gia Dinh*; *Tan San Nhut*; *Saigon*; *Tay Ninh*; *Bien Hoa*; *Long Khanh*: *Gia Ray*; *Binh Duong*: *Lai Khe*; *Vinh Long*; *Khanh Hoa*; *Duc My*; *Nha Trang*; *Quang Tri*: *An Khe*; *Da Nang*: *Danang*; *Spanish Point*; *Thua Thien*: *Phu Bai*; *Quang Nam*; *Quang Duc*: *Dak Song*; *Darlac*: *Ban Me Thuot*; *Tuyen Duc*: *Fyan*; *Da Lat*: *Dalat*; "Long Binh; Chu Lai;" 76♂, 201♀, 14♂ terminalia, 13 individual rearings (13 l, 12 p).

LAOS. *Champassak*: *Sedone*; *Pakse*; *Vientiane*; "Ban Van Heue;" 11♂, 11♀.

CAMBODIA. *Kandal*: *Phnom-Penh*; *Oudong*; *Kompong Speu*; *Kampot*: *Sihanoukville*; *Takeo*: *Prey Phdau*; "Ari-Ksatr; Ari-Gsatr; Chrin Chang Phnom Penh;" 17♂, 18♀.

THAILAND. *Nakhon Si Thammarat*; *Khon Kaen*; *Nan*; *Phangnga*; *Lampang*; *Prachinburi*; *Ranong*; *Nonthaburi*; *Chon Buri*; *Surat Thani*; *Ko Samui*; *Trat*; *Prachuap Kiri Khan*; *Phuket*; *Phra Nakhon*; *Nakhonsawan*; *Ang Thong*; *Maehong Son*; *Chiang Mai*; *Nakhon*; *Nayok*; *Nakhon Ratchasima*; *Loei*; *Lampoon*; *Nakhonayor*; *Chumphon*; *Trang*; *Kanchanaburi*; *Songkhla*; *Chanthaburi*; *Rayong*; *Tak*; *Yala*; 884♂, 936♀, 330♂ terminalia; 2♀ terminalia, 136 L, 902 individual rearings (563 l, 902 p).

BURMA. *Pegu Division*: *Rangoon*; *Shan State*: *Aung Ban*; 35♂, 43♀, 3♂ terminalia, 50 individual rearings (4 l, 50 p).

MALAYSIA. *West Malaysia*: *Perak*; *Perlis*; *Kedah*; *Selangor*; *Johore*; *Trengganu*; *Pahang*; *Kelantan*; 640♂, 817♀, 28♂ terminalia, 1♀ terminalia, 46 L, 402 individual rearings (285 l, 402 p). *East Malaysia*: *Sabah*- *Kalabakan*; *Sandakan*; *Tawau*; *Sawah Tuaran*; *Berbuloh Barat Labuan*; *Kota Belud*; *Saban Semporna*; *Lipasli papar*; *Penampang Jesselton*; *Keningan*; *Limbuaq Banggi*; *Lingkabau*; 25♂, 25♀. *Sarawak*- *Kuching*; *Pang Kalan Tebang*; 6♂, 8♀.

SINGAPORE. 82♂, 87♀, 1♂ terminalia, 86 individual rearings (42 l, 86 p).

INDONESIA. *Sumatra*: *Atjeh*; *Benkoelen*; *Padang Panzang*; *Fort de Kock*; *Singkarak*; *Deli*; *Tjoorab*; *Kaban Djahe*; *Nias*. *Java*: *Maos*; *Boueloeng*; *Tjandfoer*; *Tjisarua*; *Tjilatjap*; *Malang*; *Batavia*; *Kapetakan*; *Bogor*; *Bataria*; *Buitenzorg*; *Soerabna*. *Kalimantan*: *Kandangan*; *Bandjermasin*; *Tarakan*. *Celebes*: *Kalawara*; *Bintaoena*; *Mamaedfre*; *Molino*; *Makassar*; *Kabaena*. *Lesser Sunda Islands*: *Bali*; *Flores*; *Alor*. *Timor*; *Ceram*; 123♂, 148♀, 27♂ terminalia.

INDIA. *Bengal*: *Calcutta*; *Darjeeling*- *Sukna*; *Jalpaiguri*- *Old Jalpai-guri*; *Bihar*: *Patna*- *Bihar City*; *Purnea*; *Darbhanga*- *Pusa*; *Madras*: *Nilgiri*- *Coonoor*; *Nilgiri Hills*; *Delhi*; *Kanara*: *Karwar*; *Canar*: *N. Canar*; *Central Province*; *Sambalpur*; *Assam*: *Assam*; *Lakhimpur*- *Dibrugarh*; *Doom Dooma*; *Sibsagar*- *Jorhat*; "Chabua; Misamari;" 149♂, 169♀, 21♂ terminalia, 1♀ terminalia, 59 individual rearings (45 l, 59 p).

W. Pakistan. *Lahore*; 2♂, 5♀.

CEYLON. *Colombo*; *Central Province*: *Peradeniya*; "Suduganga; Diya'wa; Pundaluoya;" 10♂, 14♀.

- NEPAL. Hetaura, 2,000 ft; 3♂.  
 JAPAN. Honshu: Tokyo; Yokohama; Kyoto; Kiushiu: Nagasaki; 9♂, 10♀, 1♂ terminalia.  
 BONIN ISLANDS. 4♀.  
 HAWAIIAN ISLANDS. Oahu: Mokapu Point; Hawaii: Kona Coast; 4♀, 84♂ terminalia.  
 CHAGOS ISLANDS. Peros Banhos; Diamont Island; 1♀.  
 SEYCHELLES. Mahe; Praslin; Platte; Capucin; Silhouette; Victoria; Dennis; 37♂, 60♀.  
 LA REUNION. 2♂, 3♀.  
 MAURITIUS. 1♂, 5♀.  
 MADAGASCAR. 3♂, 1♀.  
 MARIANA ISLANDS. Guam; Saipan; 4♂, 4♀.

REMARKS. A great number of specimens of this species have been examined and as it has been collected from many places and administrative divisions in some countries, such as Thailand, Philippines, Ryukyu Islands and Malaya, detailed locality records are therefore not presented here but are available at SEAMP.

TAXONOMIC DISCUSSION. *A. albopictus* is one of the commonest species in Southeast Asia. The adult can easily be distinguished from all other members of the *scutellaris* group in this area by having the scutum with a patch of broad flat white scales on the lateral margin just before the level of the wing root, no small white patch on the scutal angle area, and abdominal tergal white bandings basal and not connected with the lateral white spots. Tergum IX of the male terminalia has a conspicuous horn-like median projection, thus differing from all other species that have been described in this group.

*A. albopictus* is a member of the *albopictus* subgroup, having the supraalar white line not clearly defined, with only narrow scales over the wing root, and the abdominal tergal markings basal and not connected with the lateral markings; it can thus easily be distinguished from all other members of the *scutellaris* subgroup. However, the immature stages of this species are extremely similar to those of *alcasidi*, *malayensis*, *riversi* and *scutellaris* which belong to the *scutellaris* subgroup. In Southeast Asia, the larvae of *albopictus* are often found in association with those of *alcasidi*, *malayensis* and *riversi* in the field. Thus great care must be taken in identifying them. The larva of *albopictus* can be distinguished from *alcasidi*, *malayensis* and *riversi* by having abdominal hair 1-VII usually 4-, sometimes 3-branched, and always much shorter and stronger; in the 3 other species hair 1-VII usually with 2 (2-3) long branches. The pupa of *albopictus* having hair 6-C about 1/2 of 7-C, can also be distinguished from the 3 other species which have hair 6-C usually much stouter than 7-C and at least 3/4 of 7-C to about as long as 7-C.

BIOLOGY. The immature stages of *albopictus* have been found mainly in tree holes, bamboo stumps and artificial containers in Philippines, Ryukyu Islands, Taiwan, Viet Nam, Thailand, Malaysia, Burma and India. They have also been found in coconut shells in the Philippines, Thailand and Malaysia, in rock holes in the Philippines and Thailand, in palm fronds in Malaysia and in fallen abaca leaf and leaf axils in the Philippines. The immature stages have been collected associated with *malayensis* in Singapore, Malaya, Thailand and Taiwan, with *alcasidi* in the Philippines, with *riversi* in Ryukyu Islands, with *pseudalbopictus* in Thailand, Malaya, Burma and India, with *seatoi* in Thailand, with *downsi* in Ryukyu Islands and with *subalbopictus* in India.

Feng (1933) found the parasite *Lankesteria culicis* in one out of six adult *albopictus* dissected in Woosung, China. According to his report the pathogenicity of *L. culicis* to mosquitoes is that in light infection it does very

little harm to the host but if the infection is a heavy one the larvae or pupae frequently fail to hatch and die. Certainly this deserves further examination and it may well find a place in biological control.

Gubler (1970a) found that males of *albopictus* mate readily with females of *polynesiensis* Marks and that they are strong competitors of *polynesiensis* males for these females. A cage colony of *polynesiensis* was eradicated by the addition of *albopictus* males, at a ratio of 10 *albopictus* males to 1 *polynesiensis*. The same author (1970b) reports that the competitive displacement principle does apply to *albopictus* and *polynesiensis* under laboratory conditions and suggested that a field trial should be considered.

Earlier reports on hybridization experiments between *Aedes aegypti* (Linnaeus) and *A. albopictus* (Skuse) are conflicting. However, Leahy & Craig (1967) found that the potential for hybridization between *aegypti* and *albopictus* is extremely low and that at least five barriers act in sequence to isolate these species, namely, (1) Mating behavior; (2) Structural incompatibility; (3) Sperm inactivation; (4) Reduced oviposition and (5) Genetic incompatibility. These barriers make successful hybridization in the field highly improbable and earlier reports of success may have been due to contamination.

**MEDICAL IMPORTANCE.** *A. albopictus* is one of the most important species from the standpoint of the transmission of pathogens. Table I (page 18) shows briefly what is known in this regard.

#### *AEDES (STEGOMYIA) DOWNSI* BOHART & INGRAM

(Figs. 4, ♂ terminalia, pupa; 5, larva; 8B, claspette; 20N, hind leg)

*Aedes (Stegomyia) downsi* Bohart & Ingram 1946, J. Wash. Acad. Sci. 36(2): 51 (♂\*, ♀, L\*); Bohart & Ingram 1946, U.S. Navmed 1055:64 (♂, ♀, L).  
*Aedes (Stegomyia) flavopictus downsi* Bohart & Ingram, Bohart 1953, Proc. ent. Soc. Wash. 55:184 (to ssp. status).

**MALE. Head.** Proboscis dark scaled, without any pale scales on ventral side, longer than fore femur; palpus dark, as long as proboscis, with white basal band on each of segments 2-5; bands on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, shorter than proboscis. **Thorax.** Scutum with narrow dark scales and a prominent median stripe of similar white ones, median stripe narrows slightly posteriorly and forks at beginning of prescutellar space; prescutellar line with some pale yellowish scales; on each side a posterior dorsocentral pale yellowish line which does not reach to middle of scutum; posterior scutal lines usually rather dull and indistinct; a patch of narrow curved yellowish scales on lateral margin just before level of wing root and a few narrow curved pale yellowish scales over wing root; posterior pronotum with a patch of broad white scales and some dark narrow ones dorsally; postspiracular area without scales; subspiracular area without scales; mesepimeral scale patches connected in the form of a 'V', the open end of 'V' directed backwards. **Wing.** With dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.5 times as long as its stem. **Halter.** With dark scales. **Legs.** Fore and mid femora dark anteriorly, paler posteriorly; hind femur anteriorly with a broad white stripe which widens at base and on about basal 3/5; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-4, ratio of length of white band to total length of tarsomeres 1-4 is 1/5, 1/4, 1/3-2/5, 5/6-9/10, tarsomere 5 all white or sometimes with a few dark scales at tip on ventral side. **Abdomen.** Abdominal segment I with white scales on laterotergite; terga IV-VI each with a basal white band and lateral white spots which

TABLE I. VERTEBRATE PATHOGENS ASSOCIATED WITH *Aedes* (*Stegomyia*) *albopictus*. (Skuse)

| Pathogen                        | Country     | Condition or Source | Result   | Reference                     |
|---------------------------------|-------------|---------------------|--|-------------------------------|
| <i>Dirofilaria immitis</i>      | France      | in laboratory       | can be infected                                      | Galliard & Ngu (1938)         |
| <i>Dirofilaria</i> spp.         | Thailand    | from wild-caught    | 3rd stage larvae recovered                           | Harinasuta et al. (1970)      |
| <i>Plasmodium lophurae</i>      | U. S. A.    | in laboratory       | can be infected & transmit to ducks                  | Laird (1941), Jeffery (1944)  |
| <i>Plasmodium gallinaceum</i>   | India       | in laboratory       | can be infected & transmit to fowls                  | Russell & Menon (1942)        |
| <i>Plasmodium fallax</i>        | U. S. A.    | in laboratory       | can be infected & transmit to pigeons                | Huff et al. (1950)            |
| Dengue virus                    | Formosa     | in laboratory       | can transmit from man to man                         | Koizumi et al. (1917) *       |
| Dengue virus                    | Philippines | in laboratory       | can transmit from man to man                         | Simmons et al. (1930a, 1930b) |
| Western Encephalitis virus      | U. S. A.    | in laboratory       | can transmit from guinea pig to guinea pig           | Simmons et al. (1936)         |
| Eastern Encephalitis virus      | France      | in laboratory       | can be infected                                      | Roubaud et al. (1941)         |
| West Nile virus                 | U. S. A.    | in laboratory       | can transmit from hamster to hamster                 | Philip & Smadel (1943)        |
| West Nile virus Tamilnad Strain | India       | in laboratory       | can transmit from chick to chick                     | Varma (1960)                  |
| Chikungunga virus               | India       | in laboratory       | can transmit from mouse to mouse                     | Rao et al. (1964)             |
| Japanese Encephalitis virus     | U. S. A.    | in laboratory       | can transmit from chick to chick                     | Gould et al. (1965)           |
| Dengue virus type-2             | Thailand    | from wild-caught    | isolation of virus                                   | Gould et al. (1968, 1970)     |
| Dengue virus type-4             | Thailand    | from wild-caught    | virus recovered during outbreak of hemorrhagic fever | Russell et al. (1969)         |
| Dengue virus type-2             | Singapore   | from wild-caught    | isolation of virus                                   | Rudnick & Chan (1965)         |
| Dengue virus type-1, 2          | Singapore   | from wild-caught    | virus recovered during epidemic hemorrhagic fever    | Chan et al. (1971)            |

\* These authors reported successful transmission with *Aedes scutellaris* but it seems certain that they were working with *albopictus*.

do not connect with basal bands; terga II, III, VII with lateral white spots only; or sometimes tergum III also with basal white band; abdominal basal bands usually rather weak or incomplete; sterna III-VI with basal white bands; sternum VIII largely covered with white scales. *Terminalia*. Basimere 2.5 times as long as wide; with patch of hairs on basomesal area of dorsal surface; mesal surface membranous; claspette large, somewhat fan-shaped, apical angle reaching to 0.8 of basimere, with numerous setae and several widened specialized ones on mesal side of expanded distal part; distimere simple, elongate, as long as basimere; with a spiniform process and a few hairs at apex; tergum IX with middle part produced into a large lobe, apical margin of lobe sharply serrate and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on apical half. Abdominal basal bands on terga II-VII, or as in male; segment VIII largely retracted.

**PUPA.** *Cephalothorax*. Trumpet about 3 times as long as width at middle; hair 1, 3-C single; longer than 2-C; 2-C single; 4-C usually double; 5-C usually double (2-3); 6-C single, stout, shorter than 7-C; 7-C usually single (1-2); 10-C usually with 2-3 branches, mesad and caudad of 11-C; 11-C single. *Abdomen*. Hair 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; hair 1-II usually with 8-9 branches (3-12); 2-II laterad of 3-II; hair 2-IV, V mesad of hair 1-IV, V; hair 1-III usually 3-branched (2-6); hair 3-II, III single, shorter than segment III; hair 5-IV-VI single, or hair 5-IV, V double, not reaching beyond posterior margin of following segment; hair 9-I-V small, single, simple; 9-VI, VII stouter than preceding ones; hair 9-VI single and barbed; 9-VII usually single, barbed, or with 2 branches at tip; 9-VIII usually with 2 main stems (1-2), each with lateral branches of varying length, reaching beyond fringe of paddle. *Faddle*. Margins with fringe; hair 1-P single.

**LARVA.** *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; inner mouth brushes pectinate at tip; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5, 8, 9, 13-C single; 6-C single or double; 10-C single or double; 7-C with 2-3 branches; 11-C with 2-4 branches; 12, 15-C with 2-3 branches; 14-C with 3-5 branches; mentum with 13-14 teeth on each side. *Thorax*. Hair 1-P 3-branched; 2-P single; 3-P double; 4-P 3-branched; 5, 6-P single; 7-P double; 9-P usually single (1-2); 11-P usually single (1-2); 14-P with 3-4 branches; 5, 7-M single; 6-M with 3-4 branches; 8-M with 4-5 branches; 9-M with 2-3 branches; 10, 12-M single, long, stout; 11-M single, small; 7-T with 4-6 branches; 9-T usually double (2-3); 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen*. Hair 6-I 3-branched; 7-I single; hair 6-II with 2-3 branches; 7-II 3-branched; 6-III-V double; 6-VI single; 1-VII 4-branched; 2-VII 3-branched; comb of 8-12 scales in a single row, each scale with fine denticles at base of apical spine; pentad hair 2, 4-VIII single; 1-VIII with 4-5 branches; 3-VIII with 5-6 branches; 5-VIII with 4-6 branches; siphon short, about twice as long as wide, acus absent; pecten teeth 10-14 in number, evenly spaced, each tooth with 3 (1-3) basal denticles; 1-S with 4-5 branches, inserted beyond last tooth and in line with teeth; saddle incomplete; marginal spicules very small and inconspicuous; 1-X 2-branched (2-3); 2-X 2-branched; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single; no precratal tufts; anal papillae about 1.5 times as long as saddle, dorsal pair longer than ventral pair.

**TYPE DATA.** *Aedes (Stegomyia) downsi* Bohart & Ingram, holotype male in U.S. National Museum, Washington, D.C.; type locality: Chizuka, Okinawa (RYUKYU-RETTO), IX-1945 (R. Bohart & R. Ingram). Paratypes: 3 males, 4 females, with same data as holotype; 2 males, 2 females, Chizuka, Okinawa, VIII-1945; 5 males, 13 females, Shana Wan, Okinawa, IX-X-1945; 2 males, Heddo, Okinawa, IX-1945; 1 male, Hentona, Okinawa, IX-1945



in U.S. National Museum; 2 males, 1 female, Shana Wan, *Okinawa*, IX-1945 in British Museum (Natural History). Paratype larvae, all from *Okinawa*: 8 larvae on 7 slides, Shana Wan, IX-1945; 1 larva on slide, Shana Wan, 29-IX-1945, ex tree hole (this larva appears to be *albopictus*); 2 larvae on 1 slide, Hedo, IX-1945 in U.S. National Museum. All specimens collected by Bohart & Ingram.

**DISTRIBUTION.** 118 specimens examined: 21♂, 43♀, 16♂ terminalia, 10 L, 14 individual rearings (14 l, 14 p).

**RYUKYU ISLANDS.** *Okinawa*: Chizuka; 8♂, 8♀, 6♂ terminalia; Shana Wan; 8♂, 15♀, 5♂ terminalia, 8 L; Heddo; 2♂, 2♂ terminalia, 2 L; Hentona; 1♂, 1♂ terminalia (VIII-X-1945, all collected by Bohart & Ingram). *Iriomote*: (25-V-1968, A. B. Silagan), 1♀, 1 individual rearing (1 l, 1 p); Yabu village (XII-1968, A. B. Silagan), 5♀, 5 individual rearings (5 l, 5 p). *Yaeyama*: Inoto (7-X-1968, G. Takaesu), 5♀, 5 individual rearings (5 l, 5 p); Ishigaki city, Shiraho village (I-1970, I. V. Villanueva), 1♂, 2♀, 1♂ terminalia, 3 individual rearings (3 l, 3 p). *Ishigaki-Jima*: (X-XI-1961, Sasa), 1♂, 5♀, 1♂ terminalia. *Amami*: (V-1962, Sasa), 2♀.

**TAXONOMIC DISCUSSION.** *A. downsi* is a member of the *albopictus* subgroup. The adult differs from *albopictus*, *seatoi*, *pseudalbopictus*, *subalbopictus* and *novalbopictus* by having the scutum with a patch of narrow, curved, yellowish scales on lateral margin just before level of wing root, and fore and mid femora without pale scales scattered on anterior surface. It is very similar to *flavopictus* and *patriciae*, but can easily be distinguished from both by having subspiracular area without scales, hind femur anteriorly with a white stripe on basal 3/5 and hind tarsomere 4 with basal 5/6-9/10 white banded; in *flavopictus* and *patriciae* the subspiracular area bears scales, hind femur anteriorly has a white stripe on at least 3/4 and hind tarsomere 4 has basal 2/3-3/4 white banded at most. The male terminalia of this species have center of tergum IX produced into a large lobe, and apical margin of lobe serrate, and can thus easily be distinguished from all other species except *flavopictus*. The similarity between these two forms is so close that one would be inclined to regard *downsi* as a subspecies of *flavopictus*. However, it can be separated from *flavopictus* by the diagnostic characters mentioned in the key. In addition, the immature stages of *downsi* are markedly differentiated from *flavopictus*. The larva of *downsi* has the saddle incomplete, hair 14-P with 3-4 branches, hair 11-M and 11-T usually single (1-2); in *flavopictus* the saddle is complete, hair 14-P has 5-7 branches, hair 11-M is double and 11-T double or 3-branched. The pupa of *downsi* has hair 9-VI much stouter than 9-V, at least twice as long as 9-V, hair 9-VI usually single and barbed; in *flavopictus* hair 9-VI about same magnitude as 9-V, always single and simple. Based on the morphological difference in all stages of these two forms, I believe that *downsi* should be recognized as a distinct species.

The larva of *downsi* is very similar to *patriciae* but can be separated by having a comb scale with the free portion widened at base and sharply pointed at tip; in *patriciae* the free portion of a scale is rather slender and nearly parallel-sided from base. The pupa of *downsi* is very similar to *subalbopictus* in having hair 9-VI much stouter than 9-V, but can be separated from it by having 9-VI usually single and barbed, hair 9-VIII usually with 2 main stems (1-2); each with lateral branches of varying length and reaching beyond fringe of paddle. In *subalbopictus* hair 9-VI is single and simple, hair 9-VIII usually with 2 main stems, barbed and not reaching beyond fringe of paddle.

*A. downsi* is apparently restricted to the Ryukyu Islands. The immature stages are often found in association with *albopictus* in the field. Great care must therefore be taken in identifying them. The larva of *downsi* can be distinguished from *albopictus* by having hair 2-VII with 3-4 branches, whereas in *albopictus* this hair is usually single (1-2). The pupa of *downsi* is easily distinguished from *albopictus* by having hair 9-VI much stouter than

9-V, usually single and barbed, hair 9-VII usually single and barbed or with 2 branches at tip, 9-VIII usually with 2 main stems (1-2), each with lateral branches of varying length, reaching beyond fringe of paddle; in *albopictus* hair 9-VI is about the same magnitude as 9-V, always single and simple; 9-VII is single and simple, 9-VIII usually single (1-2), barbed and reaching beyond fringe of paddle.

**BIOLOGY.** The larvae of *downsi* have been found mainly in taro leaf axils and in tree holes; once in cut bamboo and once in banana axil in Okinawa. The immature stages from Yaeyama and Iriomote were found mainly in tree holes and once in an artificial container. The specimens from Ishigaki-Jima were found in taro leaf axils and the specimens from Amami in bamboo stumps. The adult females have been taken biting in Okinawa. The immature stages were associated with *albopictus* and *iversi*.

### *AEDES (STEGOMYIA) FLAVOPICTUS* YAMADA

(Figs. 6, ♂ terminalia, pupa; 7, larva; 8A, claspette; 20O, hind leg)

*Aedes (Stegomyia) flavopictus* Yamada 1921, Annot. zool. jap. 10:52 (♂\*, ♀); LaCasse & Yamaguti 1950, Mosq. Fauna Japan and Korea :116 (♂\*, ♀\*, P\*, L\*); Sasa & Kano 1951, Jap. J. exp. Med. 21:112 (L\*); Asanuma & Nakagawa 1953, Misc. Rep. Res. Inst. nat. Resourc. Tokyo No. 31:87 (P\*); Hara 1957, Jap. J. exp. Med. 27:65 (♀\*).

**MALE.** *Head.* Proboscis dark scaled, without any pale scales on ventral side, slightly longer than fore femur; palpus dark, slightly longer than proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, shorter than proboscis. *Thorax.* Scutum with narrow dark scales and a prominent median stripe of similar white ones, stripe narrows slightly posteriorly and forks at beginning of prescutellar space; prescutellar line with some pale yellowish scales; on each side a posterior dorsocentral pale yellowish line which does not reach to middle of scutum; a patch of narrow curved golden yellowish scales on lateral margin just before level of wing root and a few narrow curved yellowish scales over wing root; sometimes a few narrow pale yellowish scales on scutal angle area; scutellum with broad white scales on all lobes, without, or sometimes with 1-2 broad dark ones at apex of mid lobe; posterior pronotum with large patch of broad white scales and some dark narrow ones dorsally; postspiracular area without scales; subspiracular area with pale scales; mesepimeral scale patches connected forming a V-shaped white-scaled patch, the open end of 'V' directed backwards. *Wing.* Dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.8 times as long as its stem. *Halter.* With pale scales. *Legs.* Fore and mid femora dark anteriorly, paler posteriorly; hind femur anteriorly with a broad white stripe which widens at base and on about basal 3/4; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of each tarsomere is 1/4, 1/3, 2/5-1/2, 2/3, tarsomere 5 all white except tip dark on ventral side. *Abdomen.* Abdominal segment I with white scales on laterotergite; terga III-VI each with a basal white band and lateral white spots which do not connect with basal band; terga II and VII with lateral white spots only, or sometimes tergum II with median white spot; sterna III-VI with basal white bands; sternum VIII largely covered with white scales. *Terminalia.* Basimere 3 times as long as wide; with a patch of hairs on basomesal area of dorsal surface; mesal surface membranous; claspette large, fan-shaped, the apical angle reaching to 0.75 of basimere, with numerous setae and several

widened specialized ones on mesal side of expanded distal part; distimere simple, elongate, as long as basimere, with a spiniform process and a few hairs at apex; tergum IX with center produced into a large lobe, apical margin of lobe serrate and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on apical half. Abdominal basal bands on terga III-VII; segment VIII completely retracted.

**PUPA.** *Cephalothorax.* Trumpet about 4 times as long as width at middle; hair 1, 3-C single; 3-C much longer than 2-C; 2-C single; 4-C usually single (1-2); 5-C usually double (2-5); 6-C single, stout, shorter than 7-C; 7-C usually single (1-2); 10-C usually with 2-3 branches, mesad and caudad of 11-C; 11-C single. *Abdomen.* Hair 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; hair 1-II with 8-10 branches; hair 2-II laterad of 3-II; hair 2-IV, V mesad of 1-IV, V; hair 1-III usually with 3-4 branches; hair 3-II, III single, shorter than segment III; hair 5-IV-VI single, not reaching beyond posterior margin of following segment; hair 9-I-VI small, single, simple; 9-VII, VIII stouter than preceding ones; hair 9-VII usually single and barbed; hair 9-VIII usually with 2 main stems (1-2), each barbed, reaching beyond fringe of paddle. *Paddle.* Margins with fringe; hair 1-P single.

**LARVA.** *Head.* Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; inner mouth brushes pectinate at tip; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; hair 5, 8, 9, 13-C single; 6-C single or double; 10-C usually single (1-2); 7-C 3-branched; 11-C with 3-4 branches; 12-C double; 14-C with 4-6 branches; 15-C double; mentum with 10-11 teeth on each side. *Thorax.* Hair 1-P 4-branched; 2-P single; 3-P 3-branched; 4-P 4-branched; 5, 6-P single; 7-P double; 9-P double; 11-P usually double (2-3); 14-P with 5-7 branches; 5, 7-M single; 6-M 4-branched; 8-M 4-branched; 9-M with 2-3 branches; 10, 12-M single, long, stout; 11-M double, small; 7-T with 4-5 branches; 9-T usually double; 10, 11-T similar to those on mesothorax, or sometimes 11-T 3-branched; 12-T much reduced. *Abdomen.* Hair 6-I with 3-4 branches; 7-I single; hair 6-II-V double; 7-II 3-branched; 6-VI single; 1, 2-VII with 4-5 branches each; comb of 8-10 scales in a single row, each scale with fine denticles at base of apical spine; pentad hair 2, 4-VIII single; 1-VIII with 7-8 branches; 3-VIII with 6-8 branches; 5-VIII with 8-9 branches; siphon short, about twice as long as wide, acus absent; pecten teeth 10-14 in number, evenly spaced, each tooth usually with 2 (2-3) basal denticles; 1-S with 3-5 branches, inserted beyond last tooth and in line with teeth; saddle complete; marginal spicules very small and inconspicuous; 1-X with 2-4 branches; 2-X 2-branched; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single except the 2 proximal ones double; 4d-X much shorter and smaller than others; no precratal tufts; anal papillae about 3 times as long as saddle, sausage-like.

**TYPE DATA.** *Aedes (Stegomyia) flavopictus* Yamada, lectotype male (selected by Y. M. Huang, 1969), lectotype male terminalia mounted on slide (YMH- '69-80) in Medical Zoology Laboratory, Institute for Infectious Diseases, University of Tokyo, Tokyo, Japan; type locality: Shiba, Tokyo, JAPAN, 20-IV-1916 (S. Yamada). Syntypes: 2 males, 1 female, with same data as lectotype; 1 female, Inage, near Tokyo, 17-V-1916 (S. Yamada); 1 female, Shiba, Tokyo, 14-V-1921 (S. Yamada) (misidentification, it is *albopictus*) in Medical Zoology Laboratory, Institute for Infectious Diseases, University of Tokyo, Tokyo.

**DISTRIBUTION.** 59 specimens examined: 20♂, 20♀, 11♂ terminalia, 4 individual rearings (4 l, 4 p).

**JAPAN.** *Honshu:* Tokyo- (12-IX-1915, S. Yamada), 1♀; Shiba (20-IV-1916, S. Yamada), 3♂, 1♀, 1♂ terminalia; Inage (17-V-1916, S. Yamada),

1♀; Chiba (VII-1949, 406 MGL), 1♂, 4♀, 1♂ terminalia; Kyoto- (IX-X-1947, 207 MSD), 1♂, 1♀, 1♂ terminalia; (VII-1949, 207 MSD), 2♂, 1♀, 1♂ terminalia; Yodo (VIII-1947, 207 MSD), 1♀; Nagaoka (24-VII-1953, Y. Shogaki & J. McClendon), 1♂, 1♂ terminalia; Saitama, Sagiya (VI-1957), 3♂, 1♀; Shizuoka, Misakubo (VIII-1969, M. Sawada & A. Yoshii), 2♂, 2♀, 1♂ terminalia, 4 individual rearings (4 1, 4 p); Hokkaido: Rubeshibe (29-VIII-1917, S. Yamada), 2♂, 2♀, 1♂ terminalia.

KOREA. (K. W. Lee), 5♂, 5♀, 4♂ terminalia.

**TAXONOMIC DISCUSSION.** *A. flavopictus* is a Palearctic species of the *albopictus* subgroup. The adult is very similar to *downsi* and *patriciae* in having the scutum with a patch of narrow, curved, yellowish scales on lateral margin just before level of wing root and fore and mid femora without some pale scales scattered on anterior surface. It is closer to *patriciae* than to *downsi* in having the subspiracular area with scales, hind femur anteriorly with a white stripe on at least basal 3/4 and hind tarsomere 4 with basal 2/3-3/4 white banded at most. It can be distinguished from *patriciae* by having the scutum with a patch of narrow, curved, golden yellowish scales on lateral margin just before level of wing root, halter with pale scales; in *patriciae* the scutal scales are pale yellowish and the halter lacks pale scales.

The male terminalia of *flavopictus* are extremely similar to *downsi* but differing in having the basimere 3 times as long as wide; claspette large, fan-shaped, apical angle reaching to 0.75 of basimere; claspette with stem widened at base and both arms rather broad and stout in lateral aspect (dissected claspette); in *downsi* basimere rather short and broad, 2.5 times as long as wide; claspette large, apical angle reaching to 0.8 of basimere, claspette with stem and both arms rather slender in lateral aspect (dissected claspette).

The larva of *flavopictus* is very similar to *novalbopictus* and *subalbopictus* in having the saddle complete. It is easily distinguished from both by having hair 14-P with 5-7 branches, hair 2-VII with 4-5 branches, comb scale and pecten tooth rather narrow and slender with sharply pointed tips; in *novalbopictus* and *subalbopictus* hair 14-P with 2-3 branches, hair 2-VII with 2-3 branches, comb scale and pecten tooth rather broad and stout. The pupa of *flavopictus* is very similar to *novalbopictus* but differs in having the paddle margins with long fringe, hair 9-VIII usually with 2 main stems (1-2), each barbed, reaching beyond fringe of paddle; in *novalbopictus* paddle margins with rather short fringe, hair 9-VIII single, strong and barbed.

*A. flavopictus* is restricted to the Palearctic Region and does not occur in Southeast Asia. It is known from Japan and Korea. In Japan, where both *albopictus* and *flavopictus* are present, there is little doubt that the immature stages of *flavopictus* will be found in association with *albopictus* in the field. Thus, great care must be taken in identifying them. The larva of *flavopictus* can easily be distinguished from *albopictus* by having hair 14-P with 5-7 branches, hair 2-VII with 4-5 branches, hair 1,5-VIII with 7-9 branches; in *albopictus* hair 14-P 3-branched, hair 2-VII usually single (1-2) and hair 1,5-VIII with 3-5 branches. The pupa of *flavopictus* can easily be distinguished from *albopictus* by having hair 9-VII single and barbed, 9-VIII usually with 2 main stems (1-2), each barbed, reaching beyond fringe of paddle; in *albopictus* hair 9-VII single and simple, 9-VIII usually single (1-2), barbed and reaching beyond fringe of paddle.

**BIOLOGY.** The immature stages of *flavopictus* have been found mainly in bamboo stumps, once in a rubber tire and once in a cement tank in Japan.

*AEDES (STEGOMYIA) NOVALBOPICTUS* BARRAUD

(Figs. 8C, D, claspette, ♂ tergum IX; 9, ♂ terminalia, pupa;  
10, larva; 20B, thorax)

*Aedes (Stegomyia) novalbopictus* Barraud 1931, Indian J. med. Res. 19:224 (♂\*); Barraud 1934, Fauna Brit. India 5:237 (♂\*, L\*).

**MALE.** *Head.* Proboscis dark scaled, with some pale scales on ventral side, slightly longer than fore femur; palpus dark, as long as proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, shorter than proboscis. *Thorax.* Scutum with narrow dark scales and a prominent median stripe of similar white ones; stripe rather narrow, forking at beginning of prescutellar space; on each side a posterior dorsocentral pale line which does not reach to middle of scutum; a patch of narrow curved pale yellowish scales on lateral margin just before level of wing root and a few narrow curved pale scales over wing root; sometimes a few narrow pale scales on anterior prescutal area; posterior pronotum with a large patch of broad white scales and some dark narrow ones dorsally; postspiracular area without scales; subspiracular area with pale scales; upper sternopleural scale patch does not reach to anterior corner of sternopleuron; mesepimeral scale patches connected forming a V-shaped white patch, the open end of 'V' directed backwards. *Wing.* Dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.7 times as long as its stem. *Halter.* With dark scales. *Legs.* Fore and mid femora dark with some pale scales scattered anteriorly, more so on mid than on fore femur, paler posteriorly; hind femur anteriorly with a broad white stripe which widens at base and is separated from apical white scale patch; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomere is 1/5, 1/4, 1/3 and 1/2, tarsomere 5 all white. *Abdomen.* Abdominal segment I with white scales on laterotergite; terga II-VI with lateral spots; terga I and II each with median white spot (holotype male) or not; terga III-VI each with basal white band; lateral spots not connected with basal bands; tergum VII with lateral white spots only; sterna I-VI with all white scales. *Terminalia.* Basimere 2.5 times as long as wide; with few (1-3) hairs on basomesal area of dorsal surface; mesal surface membranous; claspette with broad stem, with numerous setae and several widened specialized curved ones on sternal side of expanded distal part; these widened specialized curved setae with sharply pointed tips and varying in length; distimere simple, elongate, as long as basimere; with a spiniform process and a few hairs at apex; tergum IX with center produced into a rounded lobe and with a hairy lobe on each side.

**FEMALE.** Unknown.

**PUPA.** *Cephalothorax.* Trumpet short, 3 times as long as width at middle; hair 1, 3-C single, longer than 2-C; 2-C single; 4-C double; 5-C 3-branched; 6-C single, stout, shorter than 7-C; 7-C double; 10-C 3-branched, mesad and caudad of 11-C; 11-C single. *Abdomen.* Hair 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; hair 1-II usually with 12 branches (12-13); 2-II laterad of 3-II; hair 2-IV, V mesad of hair 1-IV, V; hair 1-III with 2-3 branches; hair 3-II, III single, shorter than segment III; hair 5-IV-VI single, not reaching beyond posterior margin of following segment; hair 9-I-VI small, single, simple; 9-VII, VIII stouter than preceding ones; hair 9-VII stout, single and barbed or split at tip; hair 9-VIII with strong main stem and lateral branches of varying length. *Paddle.* Margins with rather short fringe; hair 1-P single.

**LARVA. Head.** Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; hair 5, 6, 8, 9, 10, 13-C single; 7, 12, 14, 15-C double; mentum with 12-13 teeth on each side. **Thorax.** Hair 1-P 3-branched; 2-P single; 3-P double; 4-P double; 5, 6-P single; 7-P double; 9, 11-P single; 14-P 3-branched; 5, 7-M single; 6-M 3-branched; 8-M 4-branched; 9-M double; 10, 12-M single, long, stout; 11-M single, small; 7-T with 4-5 branches; 9-T double; 10, 11-T similar to those on mesothorax; 12-T much reduced. **Abdomen.** Hair 6-I double; 7-I single; 6-II double; 7-II 3-branched; 6-III single; 6-IV, V double; 6-VI single; 1-VII 4-branched; 2-VII double; comb of 8-10 scales in a single row, each scale with fine denticles or fringe at base of apical spine; pentad hair 2, 4-VIII single; 1-VIII 3-branched; 3-VIII with 6-7 branches; 5-VIII with 4-5 branches; siphon short, about twice as long as wide, acus absent; pecten teeth 13-14 in number, evenly spaced, each tooth usually with 3 (2-3) basal denticles; 1-S 4-branched, inserted beyond last tooth and ventrad of teeth; saddle complete; marginal spicules very small and inconspicuous; 1, 2-X 2-branched; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single; no precratal tufts; anal papillae about 3 times as long as saddle, sausage-like.

**TYPE DATA.** *Aedes (Stegomyia) novalbopictus* Barraud, type male (Y 534) in British Museum (Natural History), London; type locality: Pusa, Bihar, INDIA, 27-VII-1916 (S. K. S.).

**DISTRIBUTION.** 20 specimens examined: 9♂, 7♂ terminalia, 2 individual rearings (2 l, 2 p).

**INDIA.** Bihar: Darbhanga, Pusa- (27-VII-1916, S. K. S.), 1♂, 1♂ terminalia; (15-IX-1921, Shaffi), 1♂; (II-1931, Barraud), 3♂, 3♂ terminalia; (6-VII-1921), 1♂; Madras: Nilgiri, Coonoor, Nilgiri Hills (29-V-1969, B. N. Mohan), 2♂, 2♂ terminalia, 2 individual rearings (2 l, 2 p).

**THAILAND.** Chiang Mai: Huey Keo (4-II-1953, D. C. Thurman Jr.) 1♂, 1♂ terminalia.

**REMARKS.** There are 3 larval and pupal skin slides (no. 59/ $\frac{7}{30}$ , 107/ $\frac{8}{28}$ , 113/ $\frac{14}{28}$ ) in B. M., all marked India, Koti, Kasauli area, II-1931. No associated adults of these slides were found and I have not included this material in the larval and pupal descriptions.

**TAXONOMIC DISCUSSION.** The adult of *novalbopictus* is very similar to *patriciae*, *downsi* and *flavopictus* in having scutum with a patch of narrow, curved, yellowish scales on lateral margin just before level of wing root. It can easily be distinguished from them in having fore and mid femora with some pale scales scattered on anterior surface; in *patriciae*, *downsi* and *flavopictus* fore and mid femora lack such pale scales. The male terminalia of this species are very similar to *patriciae* and *subalbopictus* in having middle part of tergum IX produced into a rounded lobe, claspette large and broad, reaching to about 0.5 of basimere, expanded portion of claspette horizontal in position. It is easily distinguished from both by having the specialized setae on the sternal side of expanded portion of claspette spine-like, curved, with sharply pointed tips and of varying lengths; in *patriciae* and *subalbopictus* these setae are blade-like or clubbed, without sharply pointed tips.

The larva of *novalbopictus* is very similar to *subalbopictus* but differs in having hair 2-X 2-branched, pecten tooth usually with 3 (2-3) basal denticles, 1-S inserted just beyond last tooth and ventrad of teeth; in *subalbopictus* hair 2-X usually single, sometimes 2-branched with one much smaller than the other, pecten tooth usually with 2 (2-3) basal denticles, 1-S inserted well beyond last tooth and in line with teeth. The pupa of *novalbopictus* is very similar to *flavopictus* but differs in having paddle margins with rather short fringe, hair 9-VIII single, strong and barbed; in *flavopictus* paddle margins with long fringe, hair 9-VIII usually with 2 main stems (1-2), each barbed, reaching beyond fringe of paddle.

*A. novalbopictus*, an Oriental species of the *albopictus* subgroup, is presently known from India and northern part of Thailand. In Southeast Asia, it is known from only Chiang Mai, Thailand and is recorded here for the first time from this country.

**BIOLOGY.** The immature stages of *novalbopictus* have been found in tree holes and bamboo internodes in India.

*AEDES (STEGOMYIA) PATRICIAE* MATTINGLY

(Figs. 11, ♂ terminalia, pupa; 12, larva; 20M, hind leg)

*Aedes (Stegomyia) flavopictus* Yamada, Barraud 1931, Indian J. med. Res. 19:224 (♂\*); Barraud 1934, Fauna Brit. India 5:239 (♂\*, ♀, L\*) (misidentifications).

*Aedes (Stegomyia) patriciae* Mattingly 1954, Ann. trop. Med. Parasit. 48: 262 (♂, ♀, P\*, L).

**MALE. Head.** Proboscis dark scaled, with a few pale scales on ventral side, slightly longer than fore femur; palpus dark, as long as proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, shorter than proboscis. *Thorax.* Scutum with narrow dark scales and a prominent median stripe of similar white ones; stripe narrowed slightly posteriorly and forked at beginning of prescutellar space; on each side a posterior dorsocentral pale line which does not reach to middle of scutum; a patch of narrow curved pale yellowish scales on lateral margin just before level of wing root and a few narrow curved pale yellowish scales over wing root; sometimes a few narrow pale scales on anterior prescutal area and on scutal angle area; posterior pronotum with large patch of broad white scales and some dark narrow ones dorsally; postspiracular area without scales; subspiracular area with pale scales; upper sternopleural scale patch does not reach to anterior corner of sternopleuron; mesepimeral scale patches connected forming a V-shaped white patch, the open end of 'V' directed backwards. *Wing.* Dark scales on all veins except for minute basal spot of white scales on costa; first forked cell twice as long as its stem. *Halter.* With dark scales. *Legs.* Fore and mid femora dark anteriorly, paler posteriorly; hind femur anteriorly with broad white stripe which widens at base and is separated from apical white scale patch; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomere is 1/4, 1/3, 2/5-1/2 and 2/3-3/4, tarsomere 5 all white. *Abdomen.* Abdominal segment I with white scales on laterotergite; terga II-VI with lateral spots; tergum I with (holotype male) or without median white spot; tergum II with (holotype male) or without basal white band; terga III-VI each with a basal white band; the lateral spots do not connect with basal bands; tergum VII with lateral white spots only; sternum III-VI with basal white bands; sternum VIII largely covered with white scales. *Terminalia.* Basimere 3 times as long as wide; with a patch of hairs on basomesal area of dorsal surface; mesal surface membranous; claspette large, reaching to 0.5 of basimere, with numerous setae and several widened specialized clubbed ones on sternal side of expanded distal part; distimere simple, elongate, 0.8 as long as basimere, with a spiniform process and a few hairs at apex; tergum IX with center produced into a rounded lobe and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on apical half. Abdominal basal bands on terga II-VII; segment VIII largely retracted.

**PUPA.** *Cephalothorax.* Trumpet short, 3 times as long as width at middle; hair 1, 3-C single, longer than 2-C; 2-C single; 4-C usually single (1-2); 5-C usually 3-branched (2-3); 6-C single, stout, shorter than 7-C; 7-C usually single (1-2); 10-C usually 3-4 branched, mesad and caudad of 11-C; 11-C single. *Abdomen.* Hair 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; hair 1-II usually with 5-7 branches (4-9); 2-II laterad of 3-II; hair 2-IV, V mesad of 1-IV, V; hair 1-III usually with 1-2 branches, rarely with 3; hair 3-II, III single, shorter than segment III; hair 5-IV-VI single, short, not reaching beyond posterior margin of following segment; 9-I-VI small, single, simple; 9-VII, VIII stouter than preceding ones; hair 9-VII stout, single, simple; 9-VIII usually with 2 main stems (1-2), barbed, not reaching beyond fringe of paddle. *Paddle.* Margins with fringe; hair 1-P single.

**LARVA.** *Head.* Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; inner mouth brushes not pectinate at tip; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5, 6, 8, 9, 13-C single; 7, 12-C usually double (2-3); 10-C usually double (1-2); 11-C usually 3-branched (3-4); 14-C usually with 4-5 branches (4-6); 15-C usually 3-branched (2-3); mentum with 11-12 teeth on each side. *Thorax.* Hair 1-P 3-branched; 2-P single; 3-P double; 4-P 3-branched; 5, 6-P single; 7-P double; 9-P double; 11-P usually double (1-2); 14-P 3-branched; 5, 7-M single; 6-M 3-branched; 8-M 4-branched; 9-M 3-branched; 10, 12-M single, long, stout; 11-M single, small; 7-T usually 5-branched (5-6); 9-T usually double (2-3); 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen.* Hair 6-I 3-branched; 7-I single; 6-II double; 7-II 3-branched; 6-III-V double; 6-VI single; 1-VII usually 4-branched (3-4); 2-VII usually with 3-4 branches; comb of 8-12 scales in a single row, each scale with fine denticles or fringe at base of apical spine; comb scale with free portion rather slender, nearly parallel-sided from base and as long as attached portion; pentad hair 2, 4-VIII single; 1-VIII with 4-5 branches; 3-VIII with 5-6 branches; 5-VIII with 4-6 branches; siphon short, about twice as long as wide, acus absent; pecten teeth 9-14 in number, evenly spaced, each tooth with 2-3 basal denticles; 1-S with 3-4 branches, inserted well beyond last tooth and in line with teeth; saddle incomplete; marginal spicules very small and inconspicuous; 1-X 2-branched; 2-X 2-branched; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single except the 2 proximal ones usually double (1-2), 4d-X much shorter and smaller than others; no precratal tufts; anal papillae about 3 times as long as saddle, sausage-like.

**TYPE DATA.** *Aedes (Stegomyia) patriciae* Mattingly, holotype male, allotype female in British Museum (Natural History), London; type locality: 7,000 ft. on Krol Mountain, near Solan, Western Himalayas, INDIA, 20-VII-1923 (Barraud). Paratypes: 4 males, 4 females, with same data as holotype, in British Museum.

**DISTRIBUTION.** 87 specimens examined: 25♂, 16♀, 21♂ terminalia, 2 L, 18 individual rearings (5 l, 18 p).

**INDIA.** "Western Himalayas, Krol Mountain" (20-VII-1923, Barraud), 5♂, 5♀, 1♂ terminalia; *Punjab: Rawalpindi*, Murree, W. Kimal (1922, Gill), 1♂, 1♀.

**THAILAND.** *Chiang Mai:* (4-IV-1953, Thurman), 3♂, 4♀, 4♂ terminalia; Doi Suthep (15-VIII-1963, Sahem), 1♂, 1♀, 1♂ terminalia; Banchang Khiam (30-III-1970, SEATO), 1♂, 1♂ terminalia, 1 individual rearing (1 p); *Songkhla:* Ton Nga Chang (26-III-1965, Kol), 2♂, 2♂ terminalia, 2 individual rearings (2 p); *Tak:* Khao Salak Phra (5-VIII-1965, Sumeth), 11♂, 5♀, 11♂ terminalia, 2 L, 15 individual rearings (5 l, 15 p).

**VIET NAM.** *Quang Tri:* An Khe (5-XI-1967, Neal), 1♂, 1♂ terminalia.



**REMARKS.** There are 4 slides of larval and pupal skins and 4 of whole 4th instar larvae in B.M., all with the same data as holotype, but 3 of the larval and pupal skins (Nos. 2439, 2450, 2451) are dated 4-VII-1930 and the remaining slide (No. 2512) is dated 16-VIII-1930. Unfortunately, no associated adults of these slides can be found. I have not used this material in the larval and pupal descriptions since its true identity is not known.

**TAXONOMIC DISCUSSION.** *A. patriciae* is a member of the *albopictus* subgroup. The adult is very similar to *flavopictus*, a Palearctic species of the *albopictus* subgroup, but can be separated from it by having the scutum with a patch of narrow, curved, pale, yellowish scales on the lateral margin just before level of wing root and the halter without pale scales; in *flavopictus* these scutal scales are golden yellowish in color and the halter is pale scaled.

In Southeast Asia, *patriciae* greatly resembles *pseudalbopictus*, for which it can easily be mistaken. Thus, great care must be taken in identifying them. The adult of *patriciae* can easily be distinguished from *pseudalbopictus* by having the scutum without a patch of broad dark scales on each side of prescutellar space between prescutellar white line and postdorso-central white line.

The male terminalia of *patriciae* are very similar to *subalbopictus* but can be separated from it by tergum IX having the center produced into a rounded lobe, claspette enlarged without a 90 degree lateral distal angle in lateral aspect (dissected claspette) and with numerous setae and several widened specialized clubbed ones on sternal side of expanded distal part; in *subalbopictus* tergum IX is produced centrally as a wide, curved lobe, claspette has a broad stem and a 90 degree lateral distal angle in lateral aspect (dissected claspette) and is provided with numerous setae and several widened specialized blade-like ones on sternal side of distal part, all the setae with hooked tips and about same length as widened specialized blade-like ones.

The larva of *patriciae* is very similar to *downsi* but can be separated from it by having comb scale with free portion rather slender, nearly parallel-sided from base; in *downsi* the free portion of scale is widened at base and sharply pointed at tip. The pupa of *patriciae* resembles *pseudalbopictus* but can be separated from it by having hair 9-VIII usually with 2 (1-2) branches, each barbed and not reaching beyond fringe of paddle; in *pseudalbopictus* hair 9-VIII has 2 branches, each barbed and reaching beyond the fringe of paddle.

*A. patriciae* apparently is confined to the Oriental Region. It is presently known from India, Thailand and Viet Nam. In Southeast Asia it is reported here for the first time from Thailand (Chiang Mai, Songkhla, Tak) and Viet Nam (An Khe).

**BIOLOGY.** The immature stages of *patriciae* have been found mainly in tree holes in Thailand. The pupa from Chiang Mai, Banchang Khiam was found in a stump hole. The male from Viet Nam was caught in a light trap.

#### *Aedes (Stegomyia) pseudalbopictus* (Borel)

(Figs. 13, ♂ terminalia, pupa; 14, larva; 20C,I, thorax)

*Stegomyia pseudalbopictus* Borel 1928, Arch. Inst. Pasteur Indo-Chinie 7:85 (♂\*, ♀, L\*).

*Aedes (Stegomyia) pseudalbopictus* (Borel), Barraud 1931, Indian J. med. Res. 19:223 (♂\*); Bonne-Wepster & Brug 1932, Geneesk. Tijdschr. v. Ned.-Ind. 2:81 (♂\*, L\*); Barraud 1934, Fauna Brit. India 5:235 (♂\*, ♀, L).

**MALE. Head.** Proboscis dark scaled, with a few pale scales on ventral side, as long as fore femur; palpus dark, longer than proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete

dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, slightly shorter than proboscis. *Thorax*. Scutum with narrow dark scales and prominent median stripe of similar white ones; median stripe rather broad reaching from anterior margin to middle of scutum where it becomes very narrow or broken and is followed by an inverted Y-shaped marking which forks at beginning of prescutellar space; on each side a posterior dorsocentral white line which does not reach to middle of scutum; a patch of broad dark scales on each side of prescutellar space, between prescutellar white line and posterior dorsocentral white line; a patch of narrow curved white scales on lateral margin just before level of wing root and a few narrow curved scales over wing root; posterior pronotum with a larger patch of broad white scales and some dark narrow ones dorsally; postspiracular area with white scales; subspiracular area with pale scales; upper sternopleural scale patch reaches to anterior corner of sternopleuron; mesepimeral scale patches connected forming a V-shaped white patch, the open end of 'V' directed backwards. *Wing*. Dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.5 times as long as its stem. *Halter*. With dark scales. *Legs*. Fore and mid femora dark anteriorly, paler posteriorly; hind femur anteriorly with broad white stripe which widens at base and is separated from apical white scale patch; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomere is 1/3. 2/5. 1/2 and 2/3, tarsomere 5 all white. *Abdomen*. Abdominal segment I with white scales on laterotergite; terga II-VI each with a basal white band and lateral white spots, or sometimes tergum II with lateral white spots only; lateral spots do not connect with basal bands; tergum VII with lateral white spots only; sterna III-VI with basal white bands; sternum VIII largely covered with white scales. *Terminalia*. Basimere 3 times as long as wide, with a patch of hairs on basomesal area of dorsal surface; claspette long and slender, reaching to 0.7 of basimere, with 1 widened specialized spine-like seta and numerous setae distal to it; distimere simple, elongate, as long as basimere; with a spiniform process some distance from tip and with a few hairs; tergum IX nearly flat at middle, with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on apical half. Abdominal basal pale bands on terga II-VII; segment VIII largely retracted.

**PUPA.** *Cephalothorax*. Trumpet 3.5 times as long as width at middle; 1, 3-C single, longer than 2-C which is single; 4-C single or double; 5-C single, or double; 6-C single, stout, shorter than 7-C; 7-C single or double; 10-C usually 2-branched, mesad and caudad of 11-C; 11-C single. *Abdomen*. Hair 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; hair 1-II usually with 3-6 branches; 2-II laterad of 3-II; hair 2-IV, V mesad of 1-IV, V; hair 1-III usually 2-branched; hair 3-II, III single, shorter than segment III; hair 5-IV-VI single, not reaching beyond posterior margin of following segment; 9-I-VI small, single, simple; 9-VII, VIII stouter than preceding ones; hair 9-VII single, simple; 9-VIII with 2 branches, each barbed, reaching beyond fringe of paddle. *Paddle*. Margins with fringe; hair 1-P single.

**LARVA.** *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; inner mouth brushes pectinate at tip; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5, 8, 9, 13-C single; 6-C usually double; 7-C with 2-4 branches; 10-C single or double; 11-C with 2-4 branches; 12-C with 2-3 branches; 14-C with 3-4 branches; 15-C double; mentum with 9-10 teeth on each side. *Thorax*. Hair 1-P 3-branched; 2-P single; 3, 4-P double; 5, 6-P single; 7-P double; 9-P single; 11-P single; 14-P double; 5, 7-M single; 6-M with 2-3 branches; 8-M with 3-4 branches; 9-M 2-branched; 10, 12-M single, long, stout; 11-M

single, small; 7-T usually with 3-4 branches; 9-T double; 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen*. Hair 6-I with 2-3 branches; 7-I single; 6-II with 2-3 branches; 7-II double; 6-III double; 6-IV, V single or double; 6-VI single; 1-VII usually 2-branched; 2-VII single; comb of 6-8 scales in a single row, each scale with fine denticles or fringe at base of apical spine; pentad hair 2, 4-VIII single; 1-VIII with 2-4 branches; 3-VIII 3-branched; 5-VIII with 2-3 branches; siphon short, less than twice as long as wide, acus present, small; pecten teeth 3-6 in number, usually evenly spaced, each tooth short and stout, with 3-4 basal denticles; 1-S with 3-4 branches, inserted beyond last tooth and in line with teeth; saddle incomplete; marginal spicules very small and inconspicuous; 1-X 2-branched; 2-X 2-branched; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single; 4d-X much smaller than others; no precratal tufts; anal papillae 3 times as long as saddle, sausage-like.

**TYPE DATA.** *Stegomyia pseudalbopictus* Borel, type location unknown; type locality: Terre Rouges, COCHIN CHINA (Borel).

**DISTRIBUTION.** 681 specimens examined: 174♂, 147♀, 66♂ terminalia, 35 L, 2 l, 2 p, 152 individual rearings (99 l, 152 p).

**INDIA.** *Bengal: Darjeeling Dist.* - Sukna (III-1967, Ramalingam's team), 33♂, 11♀, 2♂ terminalia, 2 L, 10 individual rearings (7 l, 10 p); Tindharia (III-1967, Ramalingam's team), 4♂, 3♀, 6 L, 4 individual rearings (4 l, 4 p); Mungpoo (III-1967, Ramalingam's team), 7♂, 12♀, 2♂ terminalia, 6 individual rearings (1 l, 6 p); Pashok (III-1967, Ramalingam's team), 2♂.

**BURMA.** *Shan State: Aung Ban* (X-1965, de Meillon), 5♂, 4♀, 4♂ terminalia, 2 l, 6 p.

**VIET NAM.** *Thua Thien: Phu Bai* (VII-1965, R. T. Holway), 1♂, 1♂ terminalia.

**MALAYSIA.** *West Malaysia: Selangor* - (XII-1955, J. A. Reid), 5♂, 4♀, 3♂ terminalia, 9 individual rearings (6 l, 6 p); Ulu Gombak (XII-1965, Ramalingam's team), 1 L; (IX-1966, Ramalingam's team), 1♂; Ulu Langat, F.R. (X-1966, Ramalingam's team), 1♂, 1♂ terminalia; (VIII-1968, Ramalingam's team), 6♂, 4♀, 4 L, 2 individual rearings (2 l, 2 p); Bt. Kutu (V-1968, Ramalingam's team), 1♀; *Perak* - Pulau (X-1967), 1 L; Chior F.R. (X-1967), 3♂, 3♀, 3 individual rearings (1 l, 3 p); Kg. Kuala Dipang (X-1967), 9♂, 7♀, 2 individual rearings (2 p); Kg. Jalong (X-1967), 1♂, 5♀, 1 individual rearing (1 p); Lahat (X-1967), 2♂, 9♀, 1♂ terminalia, 11 individual rearings (7 l, 11 p); Lasah (X-1967), 2♂, 1♂ terminalia, 1 L, 1 individual rearing (1 p); C. Highlands Road (VII-1968), 5♂, 5♀, 2 L, 3 individual rearings (3 l, 3 p); Chenderiang (X-1968), 1♂; Kuala Kangsar (VI-1968), 2♀; Trong (VII-1968), 1♀, 1 L; all collected by Ramalingam's team; *Pahang* - Bentong Rd. (III-1967), 1♂; Kuala Lipis (IV-1967), 4♂, 10♀, 1♂ terminalia; Kuala Lipis, Pdg. Tungku (IV-1967), 1♀, 1 individual rearing (1 l, 1 p); all collected by Ramalingam's team; *Perlis* - Kg. Wang Tangga (IX-1967), 2♀; Kg. Wang Kelian (IX-1967), 2♂, 1♀; *Kedah* - Sintok F.R. (IX-1967), 5♀; *Kelantan* - Gua Musang (IV-1967), 2♂; Bertam (IV-1967), 2♂, 1♂ terminalia; Pasir Mas (X-1968), 2♂, 5♀, 1 L, 6 individual rearings (6 l, 6 p); Rantau Panjang (X-1968), 1♀, 1 individual rearing (1 l, 1 p); Machang (X-1968), 1♂, 1 individual rearing (1 l, 1 p); Kota Bharu (X-1968), 2♂, 4♀, 6 individual rearings (6 l, 6 p); all collected by Ramalingam's team.

**THAILAND.** *Nakhon Nayok*: (VI-1964, Kol & Sumeth), 2♂, 2♂ terminalia; *Kanchanaburi*: Huai Lin Thin (V-1965, Peyton & Sumeth), 6♂, 4♂ terminalia, 2 L; Huai Mae Nam Noi (V-1965, Peyton), 7♂, 5♀, 7♂ terminalia, 6 individual rearings (4 l, 6 p); Huai Bong Ti (VI-1965, Peyton), 1♀, 1 individual rearing (1 p); *Nakhon Si Thammarat*: Ban Saikae (VI-1966; Peyton's team), 1♂, 1♂ terminalia, 1 individual rearing (1 p); *Mae Hong Son*: Ban Mae Ho Nua (IX-1966, Kol), 5♀, 5 individual rearings (1 l, 5 p); *Nan*: Ban Wang Mo (VIII-1966, Somboon), 4♂, 4♀, 4♂ terminalia, 5 individual rearings (1 l, 5 p); Ban Pha Man (VIII-1966, Chaliou), 4♂, 4♂ terminalia, 3 individual

rearings (3 p); Ban Pha Hang (VIII-1966, Somboon), 1♂, 1♂ terminalia, 2 L; *Phangnga*: Kh Pak Chaung (X-1966, Kol), 1♀, 1 individual rearing (1 l, 1 p); Tak Khet (X-1966, Chaliou), 1♀, 1 individual rearing (1 p); *Surat Thani*: *Koh Samui*-Ban Li Pa Noi (IX-1967, Chaliou), 2♂, 1♀, 2♂ terminalia, 3 individual rearings (1 l, 3 p); Ban Lipa Noi (XII-1968-I-1969, Kol's team), 3♂, 1♀, 2♂ terminalia, 4 individual rearings (2 l, 4 p); *Lampang*: Ban Pha Daeng (IV-1967, Somboon), 2♂, 2♀, 1♂ terminalia, 1 individual rearing (1 p); Ban Na Kiang (IV-1967, Kol), 2♀, 3 L, 2 individual rearings (2 l, 2 p); Huai Mae Yuak (V-1968, Harrison), 17♂, 6♀, 16♂ terminalia, 2 L, 21 individual rearings (16 l, 21 p); Huai Mae Phlung (V-1968, Kol & Harrison), 2♀, 1 individual rearing (1 l, 1 p); *Nakhon Sawan*: Ban Nua Sathrni (XI-1968, Kol's team), 2♀, 2 individual rearings (2 l, 2 p); *Ang Thong*: Ban Sang Thong (IV-1969, Kol's team), 2♂, 1♀, 1♂ terminalia, 4 individual rearings (4 l, 4 p); *Chiang Mai*: Ban Rong Rua Taeng (X-1969, Kol's team), 1♀, 1 individual rearing (1 l, 1 p); Ban Kea Lek Noi (X-1969, Kol's team), 5♂, 3♀, 1♂ terminalia, 1 L, 8 individual rearings (7 l, 8 p); Banka (X-1969, Kol's team), 9♂, 5♀, 6 L, 11 individual rearings (4 l, 11 p); Ban Rong Wua Daeng (II-1970, SEATO), 3♂, 3♀, 3♂ terminalia, 6 individual rearings (5 l, 6 p); Ban Nong Pa Seet (III-1970, SEATO), 1♀, 1 individual rearing (1 l, 1 p).

JAVA. Lembang, #11839, 1♂; Tjandfoer, #7603, 1♂.

**TAXONOMIC DISCUSSION.** *A. pseudalbopictus* is a member of the *albopictus* subgroup. The adult is very similar to *downsi*, *flavopictus*, *patriciae* and *subalbopictus*, in having the scutum with a patch of narrow, curved, white to yellowish scales on lateral margin just before level of wing root, fore and mid femora without some pale scales scattered on anterior surface. However, *pseudalbopictus* can easily be distinguished from them by having the scutum with a patch of broad dark scales on each side of prescutellar space, between prescutellar white line and postdorsocentral white line, postspiracular area with scales. The male terminalia of this species are markedly different from all other members of the *albopictus* subgroup by having tergum IX nearly flat at middle, claspette long and slender, reaching to 0.7 of basimere, 1 widened specialized spine-like seta and numerous setae distal to it and the spiniform of the distimere placed some distance from the tip.

The larva of *pseudalbopictus* is quite similar to *albopictus* and also shares some similarities with *alcasidi*, *malayensis* and *scutellaris*, the members of the other subgroup. It can easily be distinguished from all other members of the group by having siphon acus present, pecten teeth 3-6 in number, each tooth short and stout and usually with 3-4 basal denticles. The pupa of *pseudalbopictus* is very similar to *albopictus* and *patriciae* but can be separated from them by having hair 9-VIII with 2 branches, each barbed, reaching beyond fringe of paddle; in *albopictus* hair 9-VIII is usually single (1-2); when it is 2-branched, then only the male pupa can be separated from *pseudalbopictus* by having the male genital lobe short and broad, about as long as wide, whereas in *pseudalbopictus* it is rather long and narrow, longer than wide; in *patriciae* hair 9-VIII usually with 2 (1-2) branches, each barbed, not reaching beyond fringe of paddle.

*A. pseudalbopictus* apparently is a common species in the Oriental Region and extends into the western part of the Indomalayan area. It is presently known from India, Burma, Thailand, Viet Nam, W. Malaysia and Java. The species is recorded here for the first time from Burma, Thailand and Java.

**BIOLOGY.** The immature stages of *pseudalbopictus* have been found mainly in bamboo stumps in Burma, India, Malaysia and Thailand. It has also been found in fallen split bamboo, coconut shells and artificial containers in Malaysia and in bamboo internodes, bamboo cups, bamboo pots, split bamboos and tree holes in Thailand. The immature stages were associated with *albopictus*.

*Aedes (Stegomyia) seatoi* HUANG

(Figs. 15, ♂; 16, ♂ terminalia, pupa; 17, larva)

*Aedes (Stegomyia) seatoi* Huang 1969, Proc. ent. Soc. Wash. 71(2):234 (♂\*, ♀, P, L\*).

**MALE. Head.** Proboscis dark scaled, without any pale scales on ventral side, as long as fore femur; palpus dark, longer than proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, slightly shorter than proboscis. **Thorax.** Scutum with narrow dark scales and a prominent median stripe of similar white ones; stripe reaches from anterior margin to middle of scutum where it becomes very narrow or broken and is followed by an inverted Y-shaped marking which forks at beginning of prescutellar space. There is on each side of this: (1) a posterior dorsocentral white line which does not reach to middle of scutum and which sometimes becomes very narrow or broken at level of wing root, (2) a small white patch of similar scales at a short distance anterior to posterior dorsocentral white line, (3) a few narrow white scales on anterior prescutal area and some narrow white ones on scutal angle area where they form a small white patch, (4) a patch of broad flat white scales on lateral margin just before level of wing root and a few similar scales on posterior portion of supraalar area. There is no complete supraalar line of broad white scales; posterior pronotum with a large patch of broad white scales and some dark narrow ones dorsally; postspiracular area without scales; subspiracular area with pale scales; mesepimeral scale patches connected forming a V-shaped patch, the open end of 'V' directed backwards. **Wing.** Dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.5 times as long as its stem. **Halter.** With dark scales. **Legs.** Fore and mid femora dark with some pale scales scattered anteriorly, more so on mid than on fore femur, paler posteriorly; hind femur anteriorly with a broad white stripe which widens at base and is narrowly separated from the apical white scale patch; fore and mid tarsi with basal white bands on tarsomeres 1-3; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomere is 2/5, 2/5, 1/2 and 2/3, tarsomere 5 all white, or sometimes with a few dark scales at tip on ventral side. **Abdomen.** Abdominal segment I with white scales on laterotergite, tergum I with a large median patch of white scales; terga II-VI each with a basal white band which widens laterally except on tergum II where it widens in middle; all segments with lateral white spots which are not connected with basal bands; tergum VII with lateral white spots only; sterna I-III largely covered with white scales; IV-VI each with a basal white band; sternum VIII largely covered with white scales. **Terminalia.** Basimere 3 times as long as wide, with a patch of hairs on basomesal area of dorsal surface; claspette long, reaching to 0.75 of basimere, with numerous setae and several widened specialized curved ones on mesal side of slightly expanded distal part; distimere simple, elongate, 0.75 as long as basimere; with a spiniform process at apex and with some hairs; tergum IX with middle part produced into a large rounded lobe and with a small hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on apical half. Abdominal tergum II with basal white band also widening laterally; abdominal basal bands on terga II-VII; segment VIII largely retracted.

**PUPA. Cephalothorax.** Trumpet short, 3 times as long as width at middle; hair 1, 3-C single, longer than 2-C; 2-C usually double; 4-C usually double; 5-C usually 4-branched (4-5); 6-C single, stout, shorter than 7-C; 7-C usually double; 10-C usually 4-branched, mesad and caudad of 11-C; 11-C

single. *Abdomen*. Hair 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2,3-I not widely separated, distance between them as distance between 4,5-I; hair 1-II usually with 8-10 branches; 2-II laterad of 3-II; hair 2-IV, V mesad of 1-IV, V; hair 1-III usually with 3-4 branches; hair 3-II, III single, shorter than segment III; hair 5-IV-VI single or double, not reaching beyond posterior margin of following segment; 9-I, II small, single, simple; 9-III-VIII stouter than preceding ones; hair 9-III-VII strongly developed, thickened; 9-VII usually single and barbed; 9-VIII with a strong main stem and lateral branches of varying length. *Paddle*. Margins with rather short fringe on apical half; hair 1-P single.

**LARVA.** *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; inner mouth brushes pectinate at tip; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; hair 5, 6, 8, 9, 13-C single; 7, 10, 12-C usually double; 11-C usually 3-branched (3-5); 14-C with 3-4 branches; 15-C usually with 2-3 branches; mentum with 10-12 teeth on each side. *Thorax*. Hair 1-P with 4-5 branches; 2-P single; 3-P 3-branched; 4-P 5-branched; 5-P with 3-4 branches; 6-P single; 7-P with 2-3 branches; 9-P usually double (1-2); 11-P single; 14-P usually 7-branched (5-9); 5, 7-M single; 6-M 3-branched; 8-M with 4-5 branches; 9-M with 2-3 branches; 10, 12-M single, long, stout; 11-M single, small; 7-T usually with 4-5 branches; 9-T double; 10, 11-T similar to those on mesothorax; 12-T much reduced; basal spine of meso- and metapleural hairs stout and straight or slightly curved. *Abdomen*. Hair 6-I with 3-4 branches; 7-I single; 6-II usually 3-branched (2-3); 7-II 3-branched; 6-III-V double; 6-VI single; 1-VII usually 5-branched; 2-VII usually 6-branched (5-8); comb of 6-10 scales in a single row, each scale with prominent denticles at base of apical spine; pentad hair 2, 4-VIII single; 1-VIII usually 6-branched (5-7); 3-VIII with 4-6 branches; 5-VIII usually 7-branched (5-8); siphon short, less than twice as long as wide, acus absent; pecten teeth 8-12 in number, evenly spaced, each tooth with 2-4 basal denticles; 1-S 4-branched, inserted beyond last tooth and in line with teeth; saddle incomplete; marginal spicules very small and inconspicuous; 1-X usually 2-branched (2-4); 2-X 2-branched; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair usually single, sometimes, however, 1 or 2 proximal ones double; no precratal tufts; anal papillae longer than saddle, lanceolate.

**TYPE DATA.** *Aedes (Stegomyia) seatoi* Huang, holotype male, with associated larval and pupal skins and terminalia on a slide, allotype female, with associated larval and pupal skins, in U.S. National Museum, Washington, D.C.; type locality: Bangphra, *Chon Buri*, THAILAND, 27-IX-1968 (Kol's team). Paratypes: same locality and collectors as holotype; 2 males, with associated larval and pupal skins and terminalia slides, 1 male, with associated pupal skin and terminalia slide, 23-IX-1968; 2 females, with associated larval and pupal skins, 17-IX-1968, in U.S. National Museum.

**DISTRIBUTION.** 454 specimens examined: 118♂, 110♀, 30♂ terminalia, 48 L, 76 individual rearings (72 l, 76 p).

**THAILAND.** *Chon Buri*: Bangphra (IX-1968), 15♂, 7♀, 15♂ terminalia, 5 L, 24 individual rearings (23 l, 24 p); Khao Mai Kao (X-1963), 1♂, 1♂ terminalia; *Kanchanaburi*: Hinlub village (VII-1964, Sumeth), 1♂, 1♂ terminalia, 1 individual rearing (1 p); *Nakhonsawan*: Ko Klang Daet (XI-1968), 5♂, 4♀, 5♂ terminalia, 9 individual rearings (9 l, 9 p); Ban Phanom Set (XI-1968), 5♂, 1♀, 5♂ terminalia, 1 L, 4 individual rearings (3 l, 4 p); Ban Ta Khian Luan (XI-1968), 3♂, 4♀, 3♂ terminalia, 7 individual rearings (7 l, 7 p); Ko Yuan (XI-1968), 1♀, 12 L, 1 individual rearing (1 l, 1 p); Khao Kop (XI-1968), 1 L; *Ang Thong*: Ban Phothong (IV-1969), 10♂, 3♀, 6 L, 11 individual rearings (11 l, 11 p); Ban Bang Chaocha (III-1969), 10♂, 1♀, 20 L, 10 individual rearings (9 l, 10 p); Ban in Pramun (IV-1969), 4♂, 4 individual rearings (4 l, 4 p); Ban Bang Thong (IV-1969), 1♂, 1 individual rearing (1 l, 1 p); Ban Sang Thong (IV-1969), 1♂, 2 individual rearings (2 l, 2 p); Amphao Murui

(III-1969), 1 L; *Chiang Mai*: Ban Pasak Khwang (X-1969), 2♂, 2 L, 2 individual rearings (2 l, 2 p); *Saraburi*: Tambol Huapluk, Ban Nam Tone, Mulo (III-1970, Prajims' team), 7♂, 37♀. Two progeny rearings: NO. (3)- 29♂, 37♀; NO. (5)- 24♂, 15♀. Except as indicated, all specimens were collected by Kol's team.

**TAXONOMIC DISCUSSION.** *A. seatoi*, a member of the *albopictus* subgroup, is a very clearly marked species in all stages. The adult is very similar to *albopictus* in having the scutum with a patch of broad flat white scales on lateral margin just before level of wing root. It can easily be recognized, however, in having the scutum with a small white patch of narrow scales on scutal angle area and abdominal tergum I with large median patch of white scales; in *albopictus* the scutum is without such a patch of scales on scutal angle area and abdominal tergum I lacks a large median patch of white scales. The male terminalia of this species are also very similar to *albopictus* but can easily be distinguished by having tergum IX with middle part produced into a large lobe and not the conspicuous horn-like median projection of *albopictus*.

The larva of *seatoi* shows some resemblance to *albopictus* and *flavopictus*. It can easily be distinguished from all other members of the group by having comb scales with prominent denticles at base of apical spine and hair 2-VII usually with 6 (5-8) branches. The pupa of *seatoi* is very similar to *downsi* but can easily be separated from it by having hair 9-III-V strongly developed, thickened, much stouter than 9-II and hair 9-VIII with a strong main stem and lateral branches of varying length; in *downsi* hair 9-III-V is not so strongly developed, slender and of about the same magnitude as 9-II, hair 9-VIII usually has 2 main stems (1-2), each with lateral branches of varying length and reaching beyond fringe of paddle.

*A. seatoi* is presently known only from Thailand. The immature stages are often found in association with *albopictus* and *aegypti* in the field. In addition, the larva having the *aegypti* type of comb scales can easily be misidentified and great care must be taken in this regard. It can easily be separated from *albopictus* by having the comb scales with prominent denticles at base of apical spine, whereas in *albopictus* the comb scales have only very fine denticles in this position. The pupa of *seatoi* is easily distinguished from *albopictus* by having hair 9-III-V strongly developed, thickened, much stouter than 9-II.

The immature stages of *seatoi* are markedly different from *aegypti*, which belongs to a different group. The larva of *seatoi* can easily be separated from *aegypti* by having hair 14-P usually with 7(5-9) branches, hair 1-VII usually 5-branched, 2-VII usually with 6(5-8) branches, ventral brush with 4 pairs of hairs on grid, each hair usually single, sometimes 1 or 2 of the proximal ones double; in *aegypti* hair 14-P usually with 2-3 branches, 1-VII usually 2-branched, 2-VII usually single, ventral brush with 5 pairs of hairs on grid, each hair branched. The pupa of *seatoi* can easily be separated from *aegypti* by having the paddle margins with fringe of hair-like spicules; in *aegypti* the margins bear distinct denticles and lack a fringe of delicate hairs.

**BIOLOGY.** The immature stages of *seatoi* have been collected mainly in bamboo pots and bamboo cups which were placed in orchard plantations, in villages and in mangrove forests in Thailand. The specimens from Kanchanaburi, Hinlub village and Chon Buri, Khao Mai Kaeo were found in banana trees and the larvae from Chiang Mai, Ban Pasak Khwang were found in a bamboo stump. The females have been taken biting man in Saraburi, Thailand. The immature stages were associated with *aegypti*, *albopictus* and *Armigeres* sp.

*AEDES (STEGOMYIA) SUBALBOPICTUS* BARRAUD

(Figs. 18, ♂ terminalia, pupa; 19, larva; 20A, L, thorax, hind leg)

*Aedes (Stegomyia) subalbopictus* Barraud 1931, Indian J. med. Res. 19:225 (♂\*); Barraud 1934, Fauna Brit. India 5:238 (♂\*).

**MALE. Head.** Proboscis dark scaled, sometimes with a few pale scales on ventral side, as long as fore femur; palpus dark, as long as proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned and with only a few short hairs; antenna plumose, shorter than proboscis. **Thorax.** Scutum with narrow dark scales and a prominent median stripe of similar white ones, which narrows abruptly a short distance in front of prescutellar bare space and forks at beginning of prescutellar space; on each side a posterior dorso-central pale line which does not reach to middle of scutum; a patch of narrow curved pale scales on lateral margin just before level of wing root and a few narrow curved pale scales over wing root; posterior pronotum with a large patch of broad white scales and some dark narrow ones dorsally; postspiracular area without scales; subspiracular area with pale scales; upper sternopleural scale patch reaches to anterior corner of sternopleuron; mesepimeral scale patches connected forming a V-shaped white patch, the open end of 'V' directed backwards. **Wing.** Dark scales on all veins except for a minute basal spot of white scales on costa; first forked cell twice as long as its stem. **Halter.** With dark scales. **Legs.** Fore and mid femora dark anteriorly, paler posteriorly; hind femur anteriorly with a broad white stripe which widens at base and is separated from apical white scale patch; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomere is 1/4, 1/4, 1/3 and 3/5, tarsomere 5 all white. **Abdomen.** Abdominal segment I with white scales on laterotergite; terga II-VI with lateral spots only (holotype male); or terga III-VI with some pale scales on basal area forming an incomplete band or indistinct bands at middle and with lateral white spots; lateral spots do not connect with basal incomplete bands; terga II and VII with lateral white spots only; sterna III-VI with basal white bands; sternum VIII largely covered with white scales. **Terminalia.** Basimere 3 times as long as wide; with a patch of hairs on basomesal area of dorsal surface; mesal surface membranous; claspette with broad stem, with numerous setae and several widened specialized blade-like ones on sternal side of distal part; all setae with hooked tips and about same length as specialized blade-like ones; there is a 90 degree lateral distal angle (dissected claspette); distimere simple, elongate, as long as basimere; with a spiniform process and a few hairs near apex; tergum IX with middle part forming a wide curved lobe and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on apical half. Abdominal basal bands incomplete at middle on terga III-VII; segment VIII largely retracted.

**PUPA. Cephalothorax.** Trumpet short, 3.5 times as long as width at middle; hair 1, 3-C single, longer than 2-C; 2-C single; 4-C usually double (1-2); hair 5-C usually 4-branched (2-6); 6-C single, stout, shorter than 7-C; 7-C usually single (1-2); 10-C usually 3-branched (3-5), mesad and caudad of 11-C; 11-C single. **Abdomen.** Hair 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; hair 1-II usually with more than 10 branches (5-12); 2-II laterad of 3-II; hair 2-IV, V mesad of 1-IV, V; hair 1-III usually with 3-4 branches (3-5), rarely double; hair 3-II, III single, shorter than segment III; 5-IV-VI usually single (1-2), not reaching beyond



posterior margin of following segment; 9-I-V small, single, simple; 9-VI-VIII stouter than preceding ones; hair 9-VI stout, single and simple; 9-VII stout, single and barbed; 9-VIII usually with 2 main stems, barbed, not reaching beyond fringe of paddle. Paddle. Margins with fringe; hair 1-P single.

**LARVA.** *Head.* Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; hair 5, 6, 8, 9, 13-C single; 7, 10-C single or double; 12-C double; 11-C usually double (2-3); 14, 15-C usually double (2-4); mentum with 11-12 teeth on each side. *Thorax.* Hair 1-P with 3-4 branches; 2-P single; 3-P double; 4-P with 2-3 branches; 5, 6-P single; 7-P double; 9-P single; 11-P usually single (1-2); 14-P double; 5, 7-M single; 6-M 3-branched; 8-M with 3-4 branches; 9-M usually double (2-3); 10, 12-M single, long, stout; 11-M single, small; 7-T with 3-4 branches; 9-T double; 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen.* Hair 6-I with 2-3 branches; 7-I single; 6, 7-II double; 6-III-V usually double (1-2); 6-VI single; 1-VII usually 3-branched; 2-VII 3-branched; comb of 8-10 scales in a single row, each scale with fine denticles or fringes at base of apical spine; pentad hair 2, 4-VIII single; 1-VIII with 3-4 branches; 3-VIII with 4-5 branches; 5-VIII usually 4-branched (3-5); siphon short, about twice as long as wide, acus absent; pecten teeth 8-14 in number, evenly spaced, each tooth usually with 2 (2-3) basal denticles; 1-S with 3-5 branches, inserted well beyond last tooth and in line with teeth; saddle complete; marginal spicules very small and inconspicuous; 1-X 2-branched; 2-X usually single, sometimes 2-branched, one much smaller than other; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single; no precratal tufts; anal papillae about 3 times as long as saddle, sausage-like.

**TYPE DATA.** *Aedes (Stegomyia) subalbopictus* Barraud, type male (Y 149) in British Museum (Natural History), London; type locality: Bombay Deccan, *Belgaum*, INDIA, VIII-1921 (Barraud).

**DISTRIBUTION.** 39 specimens examined: 6♂, 5♀, 6♂ terminalia, 11 individual rearings (11 l, 11 p).

**INDIA.** *Bombay: Belgaum* - Bombay Deccan (VIII-1921, Barraud), 1♂, 1♂ terminalia; *Madras: Nilgiri* - Coonoor, Nilgiri Hills (14-IV-1969, B. N. Mohan), 2♂, 2♂ terminalia, 2 individual rearings (2 l, 2 p); (29-V-1969, B. N. Mohan), 3♀, 3 individual rearings (3 l, 3 p), one slide #101 (1 l, 1 p) without adult; Sim's Park (1968, B. N. Mohan), 3♂, 1♀, 3♂ terminalia, 4 individual rearings (4 l, 4 p); *Bengal: Darjeeling Dist.* - Sukna (III-1967, Ramalingam's team), 1♀, 1 individual rearing (1 l, 1 p).

**TAXONOMIC DISCUSSION.** The adult of *subalbopictus* is very similar to *pseudalbopictus* and *patriciae*. It can easily be distinguished from *pseudalbopictus* by the diagnostic characters mentioned in the key and from *patriciae* by having the scutum with a patch of narrow curved white scales on lateral margin just before level of wing root, abdominal basal bands usually incomplete or indistinct at middle, and hind tarsomere 3 with basal 1/3 white banded and tarsomere 4 with basal 3/5 white banded; in *patriciae* the scutal patch is pale yellowish in color, the abdominal basal bands are always complete on terga III-VI, hind tarsomere 3 with basal 2/5-1/2 white banded and tarsomere 4 with basal 2/3-3/4 white banded. The male terminalia of this species are very similar to *patriciae* but can be separated from it by the diagnostic characters mentioned under the discussion of *patriciae*.

The larva of *subalbopictus* is very similar to *novalbopictus* but can be separated from it by the diagnostic characters mentioned under the discussion of *novalbopictus*. The pupa of *subalbopictus* is very similar to *downsi* but can be separated from it by the diagnostic characters mentioned under the discussion of *downsi*.

*A. subalbopictus*, an Oriental species of the *albopictus* subgroup, is here recorded from India only. I have not seen any of the material mentioned by Stone et al. (1959) as coming from Hainan Island.

**BIOLOGY.** The larvae of *subalbopictus* have been found in tree holes, bamboo internodes and bamboo stumps in India. The immature stages were associated with *pseudalbopictus* and *albopictus*.

*AEDES (STEGOMYIA) ALCASIDI* N. SP.

(Figs. 21, ♂; 22, ♂ terminalia, pupa; 23, larva; 26C, claspette)

*Aedes (Stegomyia) scutellaris* (Walker), Knight & Hull 1952, Pacif. Sci. 6(2): 180 (♂\*, ♀, L) (misidentification).

This species is named for Dr. Godofredo L. Alcasid, Department of Education, National Museum, Manila, Philippines, in appreciation of his interest in the mosquitoes which has greatly furthered our knowledge of the Culicidae in the Philippines.

**MALE.** *Head.* Proboscis dark scaled, with pale scales on ventral side, longer than fore femur; palpus dark, as long as proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, shorter than proboscis. *Thorax.* Scutum with narrow dark scales and a prominent median stripe of similar white ones; stripe narrows slightly posteriorly and forks at beginning of prescutellar space; on each side a posterior dorsocentral pale line which does not reach to middle of scutum; a supraalar line of broad white scales present; posterior pronotum with narrow dark scales on upper portion and broad white scales on lower portion forming a stripe instead of a patch; postspiracular area without scales; subspiracular area with or without white scales; mesepimeral scale patches narrowly separated. *Wing.* Dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.5 times as long as its stem. *Halter.* With dark scales. *Legs.* Fore and mid femora dark anteriorly, paler posteriorly; hind femur anteriorly with a broad white stripe which widens at base and is narrowly separated from apical white scale patch; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomere is 1/3, 2/5, 1/2 and 3/4, tarsomere 5 all white. *Abdomen.* Abdominal segment I with white scales on laterotergite; tergum II dark dorsally, with lateral white spots only, or sometimes with small median spot as well; terga III-VI each with sub-basal white band which is connected to lateral spots, sometimes tergum III with sub-basal median spot and with lateral spots which are turned dorsomesally; tergum VII with lateral white spots only; sternum VIII entirely covered with white scales. *Terminalia.* Basimere 3.5 times as long as wide, with a patch of hairs on basomesal area of dorsal surface; mesal surface membranous; claspette simple, with distal expanded part subtriangular in shape, sternal and tergal sides not parallel but tapering, with 6 or 7 modified setae in a row on center of sternal side and occupying about 1/3 of it; apicotergal area with several distinctly long setae; distimere simple, elongate, as long as basimere, with a spiniform process and a few hairs near apex; tergum IX with middle rounded and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on more than apical half. Wing with first forked cell about twice as long as its stem. Abdominal terga II-III always dark dorsally, with lateral white spots which are turned dorsomesally; sometimes tergum III with sub-basal median spot as well; terga IV-VII each often with sub-basal white band which is connected to lateral spots or sometimes tergum IV with sub-basal band incomplete at middle; segment VIII entirely retracted.

**PUPA.** *Cephalothorax*. Trumpet 3.5 times as long as width at middle; hair 1, 3-C single, longer than 2-C; 2-C usually single (1-2); 4-C usually double (1-2); 5-C usually double; 6-C single, about as long as and much stouter than 7-C; 7-C usually single (1-2); 10-C usually with 3-5 branches, mesad and caudad of 11-C; 11-C single. *Abdomen*. Hair 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; hair 1-II usually with 7-11 branches; hair 2-IV, V mesad of 1-IV, V; 1-III usually 2-3 branched; 1-IV usually double (1-2); 3-II, III single, shorter than segment III; hair 5-IV-VI single, not reaching beyond posterior margin of following segment; 9-VII single and barbed or split at tip; 9-VIII usually with 2 main stems (1-2), barbed, reaching beyond fringe of paddle. *Paddle*. Margins with fringe; hair 1-P single.

**LARVA.** *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; inner mouth brushes pectinate at tip; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; hair 5, 6, 8, 9, 13-C single; 7-C usually 3-branched (2-3); 10, 12-C usually double; 11-C usually 4-branched; 14-C with 2-4 branches; 15-C usually double (2-3); mentum with 11-12 teeth on each side. *Thorax*. Hair 1-P usually 3-branched; 2-P single; 3-P double; 4-P 2-branched; 5, 6-P single; 7-P double; 9-P single; 11-P usually double; 5, 7-M single; 6-M 3-branched; 8-M with 4-5 branches; 9-M 3-branched; 10, 12-M single, long, stout; 11-M single, small; 7-T with 4-6 branches; 9-T usually 3-branched (2-3); 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen*. Hair 6-I 3-branched; 7-I single; 6-II with 2-3 branches; 7-II with 2-3 branches; 6-III-V double; 6-VI single; 1-VII usually 2-branched (2-3), long; 2-VII usually single (1-2); comb of 8-12 scales in a single row, each scale with fine denticles or fringes at base of apical spine; sometimes 2-4 comb scales connected at base; pentad hair 2, 4-VIII single; 1, 5-VIII with 3-5 branches; 3-VIII with 5-7 branches; siphon about 2.5 times as long as wide, acus absent; pecten teeth 10-16 in number, evenly spaced, each tooth with 1 large and 1-3 small basal denticles; 1-S with 3-4 branches, inserted beyond last tooth and usually before middle of siphon; saddle incomplete; marginal spicules very small and inconspicuous; 1-X 2-branched; 2-X 2-branched; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single except the 2 proximal ones usually double (1-2), sometimes 4 proximal ones double; no precratal tufts; anal papillae about 2.5 times as long as saddle, sausage-like.

**TYPE DATA.** Holotype male (11-9) with associated larval and pupal skins and terminalia slide (70/218), Dalton Pass, Nueva Ecija, Luzon, PHILIPPINES, collected as a larva in a small tree hole, 3 ft. above ground level, partially shaded, in a secondary rain forest, altitude 3500 ft., 6-VI-1969 (Huang & Peyton). Allotype female (11-6) with associated larval and pupal skins, with same data as holotype. Holotype and allotype deposited in U.S. National Museum. Paratypes: 16 males, 19 females as follows: 12 males (11-1, 12, 13; 9-4, 7, 8; 8-4, 5; 7-5, 6, 8, 9) with associated larval and pupal skins and terminalia slides; 4 males (11-104; 9-100; 8-100; 7-113) with associated pupal skins and terminalia slides; 3 females (11-7; 8-1; 7-3) with associated larval and pupal skins and terminalia slides; 11 females (11-4, 5, 8, 10, 11; 9-2, 5, 6, 9; 7-1, 7) with associated larval and pupal skins; 5 females (11-101, 102, 103; 8-101; 7-111) with associated pupal skins, all with same data as holotype. Deposited in U.S. National Museum and British Museum.

**DISTRIBUTION.** 3,670 specimens examined: 539♂, 920♀, 192♂ terminalia, 16♀ terminalia, 1,206 individual rearings (797♂, 1,206♀).

**PHILIPPINES.** Luzon: La Union - Agoo (IV-1945, J.G. Franclemont) 3♀; San Fernando (V-VI-1945, A.B. Gurney), 16♂, 12♀, 7♂ terminalia; Calongboyan (VI-1945, A.B. Gurney), 4♂, 4♀, 1♂ terminalia; Bacqui (VI-1945, A.B. Gurney), 2♂, 8♀, 1♂ terminalia; Camansi (VI-1945, A.B. Gurney), 8♀.

*Bataan*- Pandan R. (VII-1931, W.V. King), 1♀; *Pangasinan*- Bayamloang (V-1904), 1♀; San Fabian (I-1945, A. B. Gurney), 1♀. *Albay*- Malinao (VII-1964, M. Delfinado), 1♀; Subic Bay (VI-1945, Rozeboom, Knight & Laffoon), 1♀. *Luzon*: (V-1945, 32 MSU), 1♂, 3♀; (V-1945, n32 MSU), 1♂ terminalia (#662b) only without adult. *Batangas*- Calatagan (VII-IX-1967, Alcasid's team), 3♂, 5♀, 1♂ terminalia, 2 individual rearings (2 l, 2 p). *Nueva Vizcaya*- Dalton (VI-1967-IX-1968, Alcasid's team), 2♂, 6♀, 2♂ terminalia, 4 individual rearings (4 l, 4 p); Maleté (VI-1969, Huang & Peyton), 36♂, 86♀, 30♂ terminalia, 2♀ terminalia, 114 individual rearings (78 l, 114 p); Aritao (VI-1969, Huang & Peyton), 14♂, 27♀, 8♂ terminalia, 41 individual rearings (29 l, 41 p). *Nueva Ecija*- Dalton Pass (VI-1969, Huang & Peyton), 74♂, 112♀, 62♂ terminalia, 14♀ terminalia, 185 individual rearings (121 l, 185 p); Kaointalan (VI-1969, Huang & Peyton), 9♂, 47♀, 6♂ terminalia, 55 individual rearings (38 l, 55 p). *Mountain Prov.*- Lagawe (VI-1969, Huang & Peyton), 5♂, 5♀, 2♂ terminalia, 10 individual rearings (2 l, 10 p). *Laguna*- Los Banos (XI-1912), 4♀; (XI-1915), 1♀; Mt. Makiling (VI-XII-1967, Alcasid's team), 9♂, 4♀, 8♂ terminalia, 4 individual rearings (3 l, 4 p); (VII-1969, Huang & Peyton), 3♂, 8♀, 11 individual rearings (2 l, 11 p); Pakil (VI-1968, Alcasid's team), 3♂, 6♀, 2♂ terminalia, 5 individual rearings (5 l, 5 p); (VII-1969, Huang & Peyton), 2♀, 2 individual rearings (1 l, 2 p); Pangil (VI-VII-1969, Huang & Peyton), 231♂, 327♀, 17♂ terminalia, 549 individual rearings (364 l, 549 p); Lumban (VI-1969, Huang & Peyton), 2♂, 5♀, 2♂ terminalia, 7 individual rearings (6 l, 7 p); Kapatalan (VII-1969, Huang & Peyton), 20♂, 15♀, 5♂ terminalia, 35 individual rearings (21 l, 35 p); Laguna (VIII-1967-IV-1968, Alcasid's team), 1♂, 1♀, 1♂ terminalia. *Samar*: San Antonio (XII-1944, J. H. Paullus), 2♀; Oras (I-1906, Gregory), 1♂, 1♂ terminalia; Osmena (VIII-1945, Rozeboom, Knight & Laffoon), 5♂, 12♀, 3♂ terminalia. *Leyte*: Tacloban (VII-VIII-1945, H. R. Roberts), 4♀, 1 individual rearing (1 l, 1 p); (VIII-1945, Rozeboom, Knight & Laffoon), 1♀; Dagami, Mt. Lobi (VIII-1945, H. R. Roberts), 1♀; Baybay (VI-1945, Rozeboom, Knight & Laffoon), 1♀; Carigara (XI-1944, E. S. Ross), 1♂, 1♀, 1♂ terminalia; Abuyog (XI-1944, O. H. Graham), 1♀; Jinamoc I. (Nav. Med. Sch. 113), 1♀. *Mindoro*: San Jose (III-IV-1945, E. S. Ross), 6♂, 21♀, 3♂ terminalia; *Oriental*- Victoria, Alcate (VII-1969, Huang & Peyton), 12♂, 30♀, 41 individual rearings (38 l, 41 p); (VII-1969, Harrison & Kol), 8♂, 23♀, 2♂ terminalia, 30 individual rearings (15 l, 30 p); Victoria, San Pedro (VII-1969, Huang & Peyton), 1♂, 1 individual rearing (1 l, 1 p); Naujan, San Augustin (VII-1969, Huang & Peyton), 35♂, 64♀, 2♂ terminalia, 98 individual rearings (64 l, 98 p). *Mindanao*: Kabakan (V-1945, R. Staples), 1♂, 1♀, 1♂ terminalia; Zamboanga (IX-1945, Rozeboom, Knight & Laffoon), 4♂, 7♀, 2♂ terminalia; Pasanonco (IX-1945, Rozeboom, Knight & Laffoon), 1♂, 3♀. *Palawan*: Irahnan R. (VI-1945, Rozeboom, Knight & Laffoon), 10♂, 8♀, 9♂ terminalia; Tacburos (VI-1945, Rozeboom, Knight & Laffoon), 1♀; Iwahig (VI-1945, Rozeboom, Knight & Laffoon), 2♀; (XI-1968, Alcasid's team), 2♂, 6♀, 8 individual rearings (2 l, 8 p); F. A. W. 10 Camp (VI-1945, Rozeboom, Knight & Laffoon), 3♂, 3♀, 3♂ terminalia; Puerto Princesa (V-VI-1945, Rozeboom, Knight & Laffoon), 2♂, 11♀, 2♂ terminalia; (IX-1945, 19th MGL), 1♂ terminalia (Lot. P2BO-(3-4) ♂ gen. #1c, C. N. H. M.) only without adult; Camarins Norte (X-1968, Alcasid's team), 1♀, 1 individual rearing (1 p); Palawan, 1♀. *Philippine Islands* (J. H. Paullus), 1♂ terminalia (#83 Sta. 3, 45-VI-12) only without adult; Philippines, APO 321 (V-1945, E. S. Ross), 6♂. *Calicoan I.*: (I-1945, J. H. Paullus), 2♂, 6♀, 2♂ terminalia. *Basilan I.*: Isabela (1945, Rozeboom, Knight & Laffoon), 1♀. *Basbas I.*: (IV-1967; M. Delfinado), 2♂, 1♀, 2♂ terminalia, 2 individual rearings (2 p). *Sulu Arch.*: (IV-1967, M. Delfinado), 1♂, 1♂ terminalia. *Sanga Sanga I.*: Lapit-Lapit (IV-1967, M. Delfinado), 1♂.

**TAXONOMIC DISCUSSION.** *A. alcasidi* is a member of the *scutellaris* subgroup. The adult differs from all the other members of the *albopictus* subgroup by having the supraalar white line complete and well developed, with broad flat scales over wing root and toward the

scutellum. It is very similar to *malayensis*, *riversi* and *scutellaris* in having the mid femur without a median white line on anterior surface, wing with minute basal spot of white scales on costa and hind tarsomere 5 all white. The adult is indistinguishable from *scutellaris* except for the male terminalia; it can be separated from *malayensis* and *riversi* by having hind tarsomere 3 with basal half white banded and hind tarsomere 4 with basal  $3/4$  white banded; in *malayensis* and *riversi* hind tarsomere 3 has the basal  $2/5$  white banded and hind tarsomere 4 has the basal  $2/3$  white banded.

The male terminalia of *alcasidi* are very similar to *hensilli*, *malayensis* and *riversi* in having the distal expanded part of claspette subtriangular in shape in lateral aspect (dissected claspette), sternal and tergal sides not parallel but tapering and without an apicosternal angle. It is closer to *hensilli* than to *malayensis* and *riversi* because of the presence of several distinctly long setae on the apicotergal area of the claspette; it can, however, be separated from *hensilli* in having claspette with 6 or 7 modified setae in a row on center of sternal side occupying about  $1/3$  of it; in *hensilli* the claspette usually has 7 modified setae, the basal one often rather smaller, set in a row on a slight prominence on center of sternal side and occupying about  $2/5$  of it.

The larva of *alcasidi* is very similar to *albopictus*, *malayensis*, *riversi* and *scutellaris* in having no siphon acus, saddle incomplete, hair 2-X 2-branched and 2-VII usually single (1-2). It is closer to *malayensis* and *scutellaris* in having hair 1-VII usually with 2 long branches (2-3), or, when 3-branched then one much smaller than other two, siphon about 2.5 times as long as wide, pecten teeth 10-16 in number and 1-S inserted at or before middle of siphon. The larva of *alcasidi* is indistinguishable from *scutellaris* and can only be separated from *malayensis* by having hair 1-S usually inserted before middle of siphon instead of at middle; pecten teeth 10-14 in number, each tooth with 2-4 basal denticles.

The pupa of *alcasidi* is very similar to *albopictus*, *pseudalbopictus*, *malayensis*, *riversi* and *scutellaris* in having hair 9-VI about same magnitude as 9-V, 9-VII single and simple and 9-VIII reaching beyond fringe of paddle. It is closer to *malayensis*, *riversi* and *scutellaris* in having hair 6-C about  $3/4$  the length to about as long as 7-C. The pupa of *alcasidi* is indistinguishable from *scutellaris*. It can be separated from *malayensis* and *riversi* by the diagnostic characters mentioned in the key.

Although the immature stages of *alcasidi* are so similar to *scutellaris*, the male terminalia differ markedly and can easily be distinguished from those of *scutellaris* by having the claspette with distal expanded part subtriangular in shape in lateral aspect (dissected claspette), sternal and tergal sides not parallel but tapering and without an apicosternal angle; in *scutellaris* the claspette has the distal expanded part square in shape in lateral aspect (dissected claspette), sternal and tergal sides more or less parallel and the apicosternal angle present. *A. alcasidi* has been mistaken in the past for *scutellaris* (Knight & Hull, 1952) and for *malayensis* (Colless, 1962).

*A. alcasidi* is apparently restricted to the Philippines. The immature stages greatly resemble *albopictus* and since the two often occur in the same breeding places, care must be taken in identification. The discussion under *albopictus* deals with this matter.

**BIOLOGY.** The immature stages of *alcasidi* have been collected mainly in tree holes and bamboo stumps in the Philippines. It has also been found in stump holes, coconut stumps, coconut husks, coconut spathes, coconut shells; artificial containers and a shelf fungus in the Philippines. The immatures were associated with *albopictus*.

*AEDES (STEGOMYIA) ALORENSIS* BONNE-WEPSTER & BRUG

(Figs. 20G, H, ♀ abdomen; 24B, ♂ terminalia)

*Aedes (Stegomyia) variegatus* var. *alorensis* Bonne-Wepster & Brug 1932, Geneesk. Tijdschr. v. Ned.-Ind. 72 (Bijblad 2) : 92 (♂\*); Stone & Farner 1945, Proc. biol. Soc. Wash. 58: 161 (to sp. status; mentioned only); Marks 1954, Bull. Br. Mus. (nat. Hist.) Ent. 3(10): 383 (♂\*, ♀\*) (taxonomy).

**MALE.** *Head.* Proboscis dark scaled, with a few pale scales on ventral side, slightly longer than fore femur; palpus dark, slightly shorter than proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, shorter than proboscis. *Thorax.* Scutum with narrow dark scales and prominent median stripe of similar white ones; stripe narrows slightly posteriorly and forks at beginning of prescutellar space; on each side a posterior dorsocentral pale line which does not reach to middle of scutum; a supraalar line of broad white scales present; posterior pronotum with narrow dark scales on upper portion and with broad white scales on lower portion forming a white stripe instead of a white patch; postspiracular area without scales; subspiracular area without scales; mesepimeral scale patches narrowly connected. *Wing.* Dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.2 times as long as its stem. *Halter.* With dark scales. *Legs.* Fore femur dark anteriorly, paler posteriorly; fore tarsus with basal white bands on tarsomeres 1-2; mid femur with median white line on anterior surface; the rest of mid leg broken off; hind femur anteriorly with broad white stripe which widens at base and is narrowly separated from apical white scale patch; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomere is 1/4, 1/3, 2/5 and 2/3; tarsomere 5 all white. *Abdomen.* Abdominal segment I with white scales on laterotergite; tergum II with sub-basal white band and with lateral spots; spots do not connect with sub-basal band; terga III-VI each with sub-basal white band which is connected to lateral spots; sterna II-IV largely covered with white scales; sterna V-VI with basal white bands. *Terminalia.* Basimere about 3 times as long as wide; with a patch of hairs on basomesal area of dorsal surface; mesal surface membranous; claspette complex, with numerous setae on expanded distal part, each seta distinctly on a separate cone, a tergomesal finger-like process which bears 6 modified setae at tip; distimere simple, elongate, as long as basimere, with a spiniform process and a few hairs at apex; tergum IX with middle truncates and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on apical half. Fore leg broken off; only femur of mid leg remains (as in male); hind femur, tibia and tarsomere 1 only remain (as in male). Abdominal tergum II with median spot and lateral spots which are turned dorsomesally; tergum VII with complete sub-basal white band; segment VIII largely retracted.

**PUPA and LARVA.** Unknown.

**TYPE DATA.** *Aedes (Stegomyia) variegatus* var. *alorensis* Bonne-Wepster & Brug, type male in British Museum (Natural History), London; type locality: Kalabaki, Alor Island (LESSER SUNDA ISLANDS) (near Timor), 7-I-1923 (S. L. Brug & H. de Rook).

**DISTRIBUTION.** 3 specimens examined: 1♂, 1♀, 1♂ terminalia.

**INDONESIA.** Lesser Sunda Islands: Alor Island, Kalabaki (7-I-1923, S. L. Brug & H. de Rook), 1♂, 1♂ terminalia; Alor Island (30-III-1926, Van Beek), 1♀ (#6020).

**TAXONOMIC DISCUSSION.** *A. alorensis* is very similar to *paullusi* in having mid femur with median white line on anterior surface and wing with

minute basal spot of white scales on costa. It differs, however, in having the scutum without any white scales on lateral prescutal area and on scutal angle area.

The male terminalia of *alorensis* have a complex claspette with numerous setae each on a separate cone on the expanded distal part, a tergal mesal finger-like process which bears 6 modified setae at tip, not 2 as described by Bonne-Wepster & Brug (1932) and Marks (1954). It therefore differs from all other species that have been described in this group. *A. alorensis* is an Indomalayan species of the *scutellaris* subgroup. It is presently known from Alor Island only.

BIOLOGY. Unknown.

#### *AEDES (STEGOMYIA) ANDREWSI* EDWARDS

(Figs. 20D, ♀ abdomen; 24A, ♂ terminalia)

*Aedes (Stegomyia) variegatus* var. *andrewsi* Edwards 1926, Bull. ent. Res. 17: 103 (♂\*); Stone & Farner 1945, Proc. biol. Soc. Wash. 58: 159 (to sp. status); Marks 1954, Bull. Br. Mus. (nat. Hist.) Ent. 3(10): 383 (♂\*, ♀\*) (taxonomy).

**MALE. Head.** Proboscis dark scaled, with a few pale scales on ventral side, slightly longer than fore femur; palpus dark, slightly shorter than proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, shorter than proboscis. **Thorax.** Scutum with narrow dark scales and prominent median stripe of similar white ones; stripe narrows slightly posteriorly and forks at beginning of prescutellar space; on each side a posterior dorsocentral pale yellowish line which does not reach to middle of scutum; a supraalar line of broad white scales present; posterior pronotum with narrow dark scales on upper portion and with broad white scales on lower portion forming a white stripe instead of a white patch; postspiracular area without scales; subspiracular area with white scales; mesoepimeral scale patches connected forming a V-shaped white scale patch; the open end of 'V' directed backwards. **Wing.** Dark scales on all veins, without minute basal spot of white scales on costa; first forked cell 1.5 times as long as its stem. **Halter.** With dark scales. **Legs.** Fore and mid femora dark anteriorly, paler posteriorly; hind femur anteriorly with broad white stripe which widens at base and is narrowly separated from apical white scale patch; fore and mid tarsi each with basal white band on tarsomere 1; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomere is 1/5, 1/4, 1/3 and 1/2, tarsomere 5 all white. **Abdomen.** Abdominal segment I with white scales on laterotergite; terga II-VI with lunate lateral white spots only; sterna I-IV entirely white scaled; sterna V-VI with basal white bands. **Terminalia.** Basimere about 3 times as long as wide; with patch of hairs on basomesal area of dorsal surface; mesal surface membranous; claspette simple, with 4 or 5 modified setae in a row on apicosternal angle, with several rather long and stout setae on apicotergal area; distimere simple, elongate, as long as basimere, with a spiniform process and a few hairs at apex; tergum IX with middle rounded and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: proboscis all dark scaled; palpus 0.2 length of proboscis, with white scales on apical half. Wing with first forked cell about twice as long as its stem. Abdominal terga II-VII with lunate lateral white spots only; segment VIII largely retracted.

PUPA and LARVA. Unknown.

TYPE DATA. *Aedes (Stegomyia) variegatus* var. *andrewsi* Edwards, type male in British Museum (Natural History), London; type locality:

CHRISTMAS ISLAND (south of Java), III-1902 (Dr. Durham).

DISTRIBUTION. 12 specimens examined: 2♂, 8♀, 2♂ terminalia.

CHRISTMAS ISLAND (south of Java) (III-1902, Dr. Durham), 2♂, 2♂ terminalia; (X-1910, Dr. R. Kirkpatrick), 1♀; North part of Island (I-1898, Dr. C.W. Andrews), 1♀; Flying Fish Cove (IX-X-1908, Dr. C.W. Andrews), 2♀; (II-1933, F. Harms), 4♀.

TAXONOMIC DISCUSSION. *A. andrewsi* is a clearly marked species in the adult stage. It can easily be distinguished from all other members of the group by having the supraalar white line complete and well developed, with broad flat scales over wing root and toward scutellum, wing without minute basal spot of white scales on costa, mid femur without median white line on anterior surface and abdomen with lunate lateral white spots only.

The male terminalia of *andrewsi* are very similar to *scutellaris* in having claspette with distal expanded part square in shape in lateral aspect (dissected claspette), sternal and tergal sides more or less parallel and apicosternal angle present. It can easily be separated from *scutellaris* by having claspette with 4 or 5 modified setae in a row on apicosternal angle and with several distinctly long and stout setae on apicotergal area; in *scutellaris* the claspette has 5 or 6 modified setae set on a prominence close to apicosternal angle area and lacks long and stout setae on apicotergal area. *A. andrewsi* is an Indomalayan species of the *scutellaris* subgroup. It is presently known from Christmas Island only.

BIOLOGY. Unknown.

#### AEDES (STEGOMYIA) HENSILLI FARNER

(Figs. 25C, D, E, ♂ terminalia; 31C, hind leg)

*Aedes (Stegomyia) hensilli* Farner 1945, Proc. biol. Soc. Wash. 58: 59 (♂, ♀, L); Bohart & Ingram 1946, U.S. Navmed 1055 :25 (♂\*, ♀\*, L); Marks 1954, Bull. Br. Mus. (nat. Hist.) Ent. 3(10): 383, Pl. 18 (♂\*, ♀\*); Bohart 1956(1957), Insects of Micronesia, 12(1): 48 (♂\*, ♀\*, L\*).

*Aedes (Stegomyia) scutellaris hensilli* Farner, Colless 1962, Proc. Linn. Soc. N.S.W. 87: 314 (to ssp. status).

MALE. *Head*. Proboscis dark scaled, slightly longer than fore femur; palpus dark, as long as proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned and with only a few short hairs; antenna plumose, shorter than proboscis. *Thorax*. Scutum with narrow dark scales and prominent median stripe of similar white ones; stripe narrows slightly posteriorly and forks at beginning of prescutellar space; on each side a posterior dorsocentral pale line which does not reach to middle of scutum; a supraalar line of broad white scales present; posterior pronotum with narrow dark scales on upper portion and with broad white scales on lower portion forming a white stripe instead of a white patch; postspiracular area without scales; subspiracular area without scales; mesepimeral scale patches separated. *Wing*. Dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.2 times as long as its stem. *Halter*. With dark scales. *Legs*. Fore and mid femora dark anteriorly, paler posteriorly; hind femur anteriorly with broad white stripe which widens at base and is separated from apical white scale patch; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-5, the ratio of length of white band to total length of tarsomere is 1/5, 1/4, 1/3, 1/2 and 1/2. *Abdomen*. Abdominal segment I with white scales on laterotergite; tergum II dark dorsally, with lateral white spots only; terga III-VI each with sub-basal white band which is



connected to lateral spots; tergum VII with lateral white spots only; sternum VIII largely covered with white scales. *Terminalia*. Basimere 3.5 times as long as wide; with patch of hairs on basomesal area of dorsal surface; mesal surface membranous; claspette simple, with distal expanded part more or less subtriangular in shape, usually with 7 modified setae, the basal one often rather smaller, set in a row on a slight prominence at center of sternal side and occupying about 2/5 of it, apicotergal area with several distinctly long setae; distimere simple, elongate, as long as basimere, with a spiniform process and a few hairs near apex; tergum IX with middle rounded and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on more than apical half. Abdominal tergum III usually dark dorsally, with lateral white spots only, or sometimes with a sub-basal median spot as well; terga IV-VII each with a sub-basal white band, or sometimes with sub-basal incomplete bands; segment VIII largely retracted.

**PUPA.** Unknown.

**LARVA.** Not known with certainty.

**TYPE DATE.** *Aedes (Stegomyia) hensilli* Farner, holotype male in U.S. National Museum, Washington, D.C.; type locality: *Ulithi Is., W. CAROLINES*, XII-1944 (George Hensill). Paratypes: 8 males, 6 females, *Ulithi Is., W. Carolines*, XII-1944 (G. Hensill) in U.S. National Museum.

**DISTRIBUTION.** 31 specimens examined: 15♂, 8♀, 8♂ terminalia.

**W. CAROLINES, Ulithi Is. (XII-1944, George Hensill), 15♂, 8♀, 8♂ terminalia.**

**REMARKS.** There are 10 whole 4th instar larvae on 5 slides in U.S. National Museum, all marked *W. Carolines, Ulithi Is., (XII-1944, George Hensill)*. No associated larval skins and pupal skins were found and I have not used this material for larval and pupal descriptions.

**TAXONOMIC DISCUSSION.** The adult of *hensilli* is very similar to *alcasidi*, *malayensis*, *riversi* and *scutellaris* in having the mid femur without a median white line on anterior surface and wing with a minute basal spot of white scales on costa. It can easily be distinguished from them, however, by having hind tarsomere 5 with basal 1/2 white banded instead of all white.

The male terminalia of *hensilli* are very similar to *alcasidi*, *malayensis* and *riversi* in having claspette with distal expanded part subtriangular in shape in lateral aspect (dissected claspette), sternal and tergal sides not parallel but tapering and without apicosternal angle. It is closer to *alcasidi* than to *malayensis* and *riversi* in having apicotergal area of claspette with several distinctly long setae. However, *hensilli* can be separated because the claspette usually has 7 modified setae, the basal one often rather smaller, set in a row on a slight prominence at center of sternal side and occupying about 2/5 of it; in *alcasidi* claspette has 6 or 7 modified setae in a row at center of sternal side and occupying about 1/3 of it.

Colless (1957) reported a "*scutellaris*" form from Singapore as *A. hensilli* Farner. In 1962, he described this Malayan form as *A. (S.) s. malayensis* subsp. on the basis of laboratory hybridization experiments between this Malayan form and *scutellaris* from New Guinea. At the same time, he also considered that *A. hensilli* of the Carolines is a subspecies of *A. scutellaris* (Walker). Apparently he did not recognize the morphological differences between *hensilli* and *malayensis* in his paper (Colless, 1962). In fact, the male terminalia of *hensilli* are quite different from *malayensis* and can easily be identified by having the apicotergal area of claspette with several distinctly long setae, claspette usually with 7 modified setae, the basal one often rather smaller, in a row set on a slight prominence at center of sternal side and occupying about 2/5 of it; in *malayensis* the apicotergal area lacks long setae and claspette has 7-10 modified setae on center of sternal side and occupying about 1/2 of it.

The male terminalia of *hensilli*, particularly the shape of the claspette are strikingly different from *scutellaris* and can easily be recognized by having claspette with distal expanded part subtriangular in shape in lateral aspect (dissected claspette), sternal and tergal sides not parallel but tapering and without apicosternal angle; in *scutellaris* the distal expanded part is square in shape in lateral aspect (dissected claspette), sternal and tergal sides are more or less parallel and apicosternal angle is present.

*A. hensilli* is a Western Pacific Is. species of the *scutellaris* sub-group. It is presently known only from Ulithi Island, W. Carolines, and records from other localities need a critical examination.

**BIOLOGY.** The larvae of *hensilli* were found in empty coconut shells, tree holes, and to some extent in artificial containers such as tin cans as well as discarded drums, barrels, and bottles used by natives (Farner, 1945).

#### *AEDES (STEGOMYIA) MALAYENSIS* COLLESS

(Figs. 26D, E, claspette, ♀ terminalia; 27, ♂ terminalia, pupa; 28, larva; 31D, hind leg)

*Aedes (Stegomyia) hensilli* Farner, Colless 1957, Med. J. Malaya 12(2): 464 (♂\*) (misidentification).

*Aedes (Stegomyia) scutellaris malayensis* Colless 1962, Proc. Linn. Soc. N. S.W. 87: 314 (♂\*, ♀); Huang 1971, Proc. ent. Soc. Wash. 73(1): 2 (♂\*, ♀\*, P\*, L\*).

**MALE. Head.** Proboscis dark scaled, sometimes with pale scales on ventral side, slightly longer than fore femur; palpus dark, as long as proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, shorter than proboscis. **Thorax.** Scutum with narrow dark scales and prominent median stripe of similar white ones; stripe narrows slightly posteriorly and forks at beginning of prescutellar space; on each side a posterior dorso-central white line which does not reach to middle of scutum; a supraalar line of broad white scales present; posterior pronotum with narrow dark scales on upper portion and with broad white scales on lower portion forming a white stripe instead of a white patch; postspiracular area without scales; subspiracular area without scales; mesoepimeral scale patches well separated, sometimes narrowly connected. **Wing.** With dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.5 times as long as its stem. **Halter.** With dark scales. **Legs.** Fore and mid femora dark anteriorly, paler posteriorly; hind femur anteriorly with a broad white stripe which widens at base and is narrowly separated from apical white scale patch; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomere is 1/4, 1/3, 2/5 and 2/3, tarsomere 5 all white or sometimes with a few dark scales on apical ventral side. **Abdomen.** Abdominal segment I with white scales on laterotergite; tergum II dark dorsally, with lateral white spots only or sometimes with median spot as well; terga III-VI each with sub-basal white band which is connected to lateral spots, sometimes tergum III with a sub-basal median spot and with lateral spots which are turned dorso-mesally; tergum VII with lateral white spots only; sternum VIII largely covered with white scales. **Terminalia.** Basimere 3.5 times as long as wide; with a patch of hairs on the basomesal area of dorsal surface; mesal surface membranous; claspette simple, with distal expanded part subtriangular in shape, sternal and tergal sides not parallel but tapering, with 7-10 modified setae forming a prominent row on center of sternal side and occupying about

1/2 of it; distimere simple, elongate, as long as basimere, with a spiniform process and a few hairs near apex; tergum IX with middle rounded and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on apical half. Wing with first forked cell about twice as long as its stem. Abdominal tergum I sometimes with median spot; tergum II always dark dorsally, with lateral spots which are turned dorsomesally; tergum III often dark dorsally, with lateral spots only, or sometimes as in male; terga IV-VII each often with complete sub-basal transverse white band which is connected to lateral spots, or sometimes with incomplete sub-basal band on tergum IV; segment VIII largely retracted; sternum VIII with conspicuous rounded lateral lobe; post-genital plate with shallow notch; cerci short and broad; 3 spermathecae, 1 larger than other 2.

**PUPA.** *Cephalothorax.* Trumpet 3 times as long as width at middle; hair 1, 3-C single, longer than 2-C; 2-C usually single (1-2); 4-C usually single (1-2); 5-C usually 2-branched (2-3); 6-C single, much stouter than 7-C, slightly shorter than 7-C; 7-C usually single (1-2); 10-C usually with 3-4 branches, mesad and caudad of 11-C; 11-C single. *Abdomen.* Hair 1-I well developed, with more than 10 branches, dendritic; hair 2-II laterad of 3-II; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; hair 1-II usually with 7-12 branches; hair 2-IV, V mesad of 1-IV, V; hair 1-III usually with 2-8 branches; 1-IV usually double (1-2); 3-II, III single, shorter than segment III; 5-IV-VI single, not reaching beyond posterior margin of following segment; hair 9-VII single, simple; 9-VIII usually with a strong main stem (1-2) and lateral branches of varying length. *Paddle.* Margins with fringe; hair 1-P single; 2-P sometimes present.

**LARVA.** *Head.* Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; inner mouth brushes pectinate at tip; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; hair 5, 6, 8, 9, 13-C single; 7, 12-C double; 10-C usually single (1-2); 11-C usually 3-branched (3-4); 14, 15-C usually double (2-3); mentum with 11-12 teeth on each side. *Thorax.* Hair 1-P usually 3-branched (2-3); 2-P single; 3-P double; 4-P 2-branched; 5, 6-P single; 7-P double; 9-P single; 11-P usually double (1-2); 5, 7-M single; 6-M 3-branched; 8-M with 4-5 branches; 9-M usually 3-branched (2-3); 10, 12-M single, long, stout; 11-M single, small; 7-T usually 5-branched (5-7); 9-T usually double (2-3); 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen.* Hair 6-I usually 4-branched (3-4); 7-I single; 6-II usually 3-branched (2-3); 7-II usually 3-branched (2-3); 6-III-V double; 6-VI single; 1-VII usually 2-branched (2-3), long; 2-VII usually single; comb of 8-12 scales in a single row, each scale with fine denticles or a fringe at the base of the apical spine; sometimes a few (2-4) comb scales connected at base; pentad hair 2-VIII distant from 1-VIII; 1, 5-VIII with 3-4 branches; 3-VIII with 5-9 branches; 2, 4-VIII single; siphon short about 2.5 times as long as wide, acus absent; pecten teeth 10-14 in number, evenly spaced, each tooth with 2-4 basal denticles; 1-S with 4-5 branches, inserted beyond last tooth and usually at middle of siphon; saddle incomplete; marginal spicules very small and inconspicuous; 1-X 2-branched; 2-X 2-branched; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single except the 2 proximal ones usually double (1-2), sometimes 4 proximal ones double; no precratal tufts; anal papillae long and about 4 times as long as saddle, sausage-like.

**TYPE DATA.** *Aedes (Stegomyia) scutellaris malayensis* Colless, holotype male, allotype female (both from laboratory colony) in the Australian National Insect Collection, Canberra; type locality: Palau Hantu, Keppel Harbour, SINGAPORE (Colless 1962). Paratypes: 4 males, 4 females in U. S. National Museum, 2 males, 2 females in British Museum (Natural History)

London, all bearing same data as holotype male and allotype female (*A. s. malayensis*, Ex. Lab. Colony from Singapore, 1962).

DISTRIBUTION. 3,332 specimens examined: 710♂, 808♀, 315♂ terminalia, 24♀ terminalia, 82L, 2L, 2p, 732 individual rearings (657 l, 732 p).

SINGAPORE. (1962, Ex. Lab. Colony, Colless), 9♂, 6♀, 7♂ terminalia; (I-1956), 1♂, 1♂ terminalia; Pulau Hantu (III-XII-1969-I-1970, W. T. Chellappah), 231♂, 205♀, 59♂ terminalia, 17♀ terminalia, 12 L, 257 individual rearings (251 l, 257 p); Pulau Blakang Mati (IV-1968, Ramalingam & James), 1♂, 5♀, 2 individual rearings (2 p).

MALAYSIA. *West Malaysia*: Pahang-Kuantan (VIII-1966, Ramalingam & Ramakoishnan), 1♀; (IX-1968, Wilson, Chia & Sulaiman), 1♂, 7♀, 2 individual rearings (2 l, 2 p); Pulau Tioman (V-1966, Ramakoishnan), 33♂, 32♀, 25♂ terminalia, 8 L, 14 individual rearings (6 l, 14 p); Kg. Lamir (IX-1968, Sulaiman, Chia & Wilson), 1♀; Kg. Cherating (X-1968, Chia & Seguan), 8♂, 22♀, 1♂ terminalia, 3 L, 24 individual rearings (24 l, 24 p); Tg. Gelang (IX-1968, Sulaiman & Chia), 12♂, 10♀, 6♂ terminalia, 15 individual rearings (12 l, 15 p). *Trengganu*-Pulau Perhentian Besar (V-1967, Ramachandran), 2♂, 3♀, 1♂ terminalia, 4 individual rearings (3 l, 4 p); Dungun (X-1968, Sulaiman, Chia & Seguan), 3♂, 7♀, 2♂ terminalia, 6 individual rearings (6 l, 6 p). *Penang Is.* -Telok Kumbor (I-1969, James, Chia & Sulaiman), 16♂, 37♀, 7♂ terminalia, 7 L, 29 individual rearings (26 l, 29 p); Pulau Perok, West of Penang (IV-1949, L. A. Gibson Hill), 1♂, 1♂ terminalia. *Langkawi Is.* - (VII-1958, R. Traub), 1♀. "West Pulau, Penins. Coast Jarak (IV-1932, E. Seimund), 4♀; Malacca Str. Pulau Jarak (XI-1958, W. W. MacDonald), 19♂, 17♀, 12♂ terminalia, 27 individual rearings (27 l, 27 p)."

THAILAND. Siam (VIII-1933, O. R. Causey), 3♂, 1♀, 3♂ terminalia. *Chon Buri*: Khao Phuthabath (VII-1964, Kol & Sumeth), 1♂, 1♂ terminalia; Top Mountain (VII-1964, Kol & Sumeth), 3♂, 2♀, 3♂ terminalia; *Ko Si Chang Is.*, Chagka Phong's cave (VII-1964, Sumeth), 2♂, 2♂ terminalia; *Ko Si Chang Is.*, Thatanavong (VII-1964, Kol), 1♀; *Ko Si Chung* (VII-1964, Kol & Sumeth), 1♀. *Songkhla*: Ton Nga Chang (III-1965, Peyton), 1♂, 1♂ terminalia, 1 individual rearing (1 p). *Chanthaburi*: Ban Laem Sing (XI-1965, Sumeth), 1♂, 1♂ terminalia, 1 individual rearing (1 p). *Nonthaburi*: Bangkok (V-1968, ARU), 58♂, 30♀, 27♂ terminalia, 5♀ terminalia; (II-IV-1969, SEATO), 86♂, 80♀, 42♂ terminalia, 97 individual rearings (89 l, 97 p). *Surat Thani*: *Ko Samui* (X-1967, XII-1968, I-1969, SEATO), 22♂, 43♀, 22♂ terminalia, 60 individual rearings (31 l, 60 p). *Trat*: *Ko Chang* (XII-1967, Kol), 1♂, 3♀, 4 individual rearings (4 p). *Phuket*: Ban Huai Luk (II-1968, Kol), 1♂, 3♀, 4 individual rearings (4 p). *Prachuap Khiri Khan*: Klong Van Hill (II-1964, Kol), 1♂, 2♀, 1♂ terminalia; Bo-Pia (IV-1968, SEATO), 42♂, 80♀, 29♂ terminalia, 20 L, 60 individual rearings (55 l, 60 p); Huai Yang Phrach Khwa (IV-1968, SEATO), 3♂, 11♀, 3♂ terminalia, 1 L, 13 individual rearings (13 l, 13 p); (SEATO's Insectory material, III-IV-1970), 39♂, 47♀, 38♂ terminalia, 2♀ terminalia, 82 individual rearings (82 l, 82 p); (VIII-1970), 83♂, 105♀, 2♂ terminalia, 31 L, 29 individual rearings (29 l, 29 p).

CAMBODIA. *Kampot*: Sihanoukville (XII-1966, J. M. Klein), 2♂, 3♀. *Kandal*: Phnom-Penh, Ari Ksatr (VII-1967, J. M. Klein), 6♂, 7♀, 2♂ terminalia; "Ari Gsatr" (V-1967, M. Delfinado), 1♀.

VIET NAM. *Con Son*: (VIII-1966, 20th PMU), 11♂, 18♀, 9♂ terminalia, 2 l, 2 p; (XI-1966, R. Hochman), 6♂, 4♀, 6♂ terminalia. *Da Nang*: Spanish Point (XII-1966, R. A. Wolff), 1♀. *Khanh Hoa*: Cam Ranh Bay (V-1967, R. Hochman), 5♀. *Binh Dinh*: An Khe (IV-1967, R. Hochman), 1♀. "Quang Tin, Nuoc Man" (V-1967, R. Hochman), 1♀.

TAIWAN. *Orchid Island* (V-1969, MAPS), 1♂, 1♂ terminalia, 1 individual rearing (1 l, 1 p).

TAXONOMIC DISCUSSION. *A. malayensis* is a member of the *scutellaris* subgroup. The adult is very similar to *alcasidi*, *riversi* and *scutellaris* in having the mid femur without median white line on anterior

surface, wing with minute basal spot of white scales on costa, hind tarsomere 5 all white. It is closer to *riversi* than to *alcasidi* and *scutellaris* in having hind tarsomere 3 with basal  $2/5$  white banded and hind tarsomere 4 with basal  $2/3$  white banded. It can be separated from *riversi* by having hind tarsomere 1 with basal  $1/4$  white banded and hind tarsomere 2 with basal  $1/3$  white banded; in *riversi* hind tarsomere 1 with basal  $1/5$  white banded and hind tarsomere 2 with basal  $1/4$  white banded.

The male terminalia of *malayensis* are very similar to *alcasidi*, *hensilli* and *riversi* in having claspette with distal expanded part subtriangular in shape in lateral aspect (dissected claspette), sternal and tergal sides not parallel but tapering and without an apicosternal angle. It is closer to *riversi* than to *alcasidi* and *hensilli* because the apicotergal area of claspette is without any distinctly long setae. It can be separated from *riversi* by having claspette with 7-10 modified setae forming a prominent row on center of sternal side and occupying about  $1/2$  of it; in *riversi* claspette has 6-8 modified setae on center of sternal side, closer to sternal angle area than to apicotergal angle area and occupying about  $2/5$  of it.

The larva of *malayensis* is very similar to *albopictus*, *alcasidi*, *riversi* and *scutellaris* in having no siphonacus, saddle incomplete, hair 2-X 2-branched and 2-VII usually single (1-2). It is closer to *alcasidi* and *scutellaris* but can be separated from both by having hair 1-S usually inserted at middle of siphon, pecten teeth 10-14 in number, each tooth with 2-4 basal denticles; in *alcasidi* and *scutellaris* hair 1-S is usually inserted before middle of siphon. The pupa of *malayensis* is very similar to *albopictus*, *pseudalbopictus*, *alcasidi*, *riversi* and *scutellaris* in having hair 9-VI of about the same thickness as 9-V, less than twice as long as 9-V, hair 9-VII single and simple and 9-VIII reaching beyond fringe of paddle. It is closer to *riversi* than to any other species in having hair 6-C much stouter than 7-C and about  $3/4$  of 7-C. It can be separated from *riversi* by having hair 9-VIII usually with a strong main stem (1-2) and lateral branches of varying length and hair 1-II with many primary and secondary branches; in *riversi* 9-VIII usually has 2 main stems (1-2), barbed, reaching beyond fringe of paddle and hair 1-II with very few secondary branches.

*A. malayensis* is highly variable in both adult ornamentation and in the immature stages. However, certain characters of the male terminalia such as the shape of the claspette and the degree of development of modified setae on the claspette are constant and unique. The shape of the claspette is strikingly different from that of *scutellaris*, from which it can easily be separated by having the claspette with distal expanded part subtriangular in shape in lateral aspect (dissected claspette), sternal and tergal sides not parallel but tapering and without an apicosternal angle; in *scutellaris* the claspette has distal expanded part square in shape in lateral aspect (dissected claspette), sternal and tergal sides more or less parallel and an apicosternal angle is present.

Colless (1962) considered *malayensis* to be a subspecies of *scutellaris* on the basis of the laboratory hybridization experiments between the Malayan form from Singapore and *scutellaris* from New Guinea. He stated in his paper that the cross appeared to be a complete success in both directions. However, I have seen his hybrids in the BM., namely, 14 adults (6♂, 8♀) and in the USNM. (2♂) and all were from a one-way cross *A. s. malayensis* (M.) X *A. s. scutellaris* (F.). Further hybridization experiments are desirable.

*A. malayensis* is apparently a common species in the Southeast Asia area. It is presently known from Taiwan, Viet Nam, Cambodia, Thailand, W. Malaysia and Singapore. In Southeast Asia the immature stages are often found in association with *albopictus* in the field and great care must be taken in identifying them. The larva and pupa of *malayensis* can be distinguished from *albopictus* by the diagnostic characters mentioned under the discussion of the latter.

**BIOLOGY.** The immature stages of *malayensis* have been collected mainly in tree holes and spathes in Singapore and in rock pools in Malaya. They have also been found in a bamboo stump, a coconut shell and artificial containers in Malaya and in rock holes, rock pools, water jars and bamboo cups in Thailand. The specimen from Orchid Island, Taiwan was found in a tree hole while the specimens from Con Son, Viet Nam were found in coconut shells. The immature stages were associated with *albopictus* in Singapore, Malaya, Thailand and Taiwan. The adult females have been taken biting man in Bo-Pia, Prachuap Khiri Khan, Thailand.

*AEDES (STEGOMYIA) PAULLUSI* STONE & FARNER

(Figs. 20E, F, J, K, ♀ abdomen, thorax, mid leg;  
29, ♂ terminalia, pupa; 30, larva)

*Aedes (Stegomyia) paullusi* Stone & Farner 1945, Proc. biol. Soc. Wash. 58: 155 (♂\*, ♀); Knight & Hull 1952, Pacif. Sci. 6(2): 178 (♂\*, ♀, L); Marks 1954, Bull. Br. Mus. (nat. Hist.) Ent. 3(10): 376, 383, Pl. 18 (♂\*, ♀\*); Bonne-Wepster 1954, Spec. Publ. R. trop. Inst. Amsterdam, 111: 84.

**MALE.** *Head.* Proboscis dark scaled, with pale scales on ventral side, longer than fore femur; palpus dark, as long as proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segment 5 with white basal band on ventral side unusually long, occupying about basal 2/3 or more; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, shorter than proboscis. *Thorax.* Scutum with narrow dark scales and prominent median stripe of similar white ones, stripe narrows posteriorly and forks at beginning of pre-scutellar space; on each side a posterior dorsocentral white line which does not reach to middle of scutum; a few narrow white scales on lateral prescutal area and on scutal angle area; a supraalar line of broad white scales present; posterior pronotum with narrow dark scales on upper portion and with broad white scales on lower portion forming a white stripe instead of a white patch; postspiracular area without scales; subspiracular area without scales; mesoepimeral scale patches separated or sometimes narrowly connected. *Wing.* Dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.5 times as long as its stem. *Halter.* With dark scales. *Legs.* Fore femur dark anteriorly, paler posteriorly; mid femur with median white line on anterior surface; hind femur anteriorly with a broad white stripe which widens at base and is narrowly separated from apical white scale patch; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomere is 1/3, 2/5, 1/2 and 2/3, tarsomere 5 all white. *Abdomen.* Abdominal segment I with white scales on laterotergite; tergum II dark dorsally, with lateral white spots only; terga III-VI each with sub-basal white band which narrows dorsally and turns abruptly caudad at lateral margin and ends there near the large oblique lateral spot or attached to it; sternum II-VI with basal white bands. *Terminalia.* Basimere about 3.5 times as long as wide; with a patch of hairs on basomesal area of dorsal surface; mesal surface membranous; claspette simple, truncate, with numerous setae, with several long, stout setae on tergal side and 4 spine-like setae on sternal side; distimere simple, elongate, as long as basimere, with a spiniform process and a few hairs near apex; tergum IX with middle truncated and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on more than apical half.

Wing with first forked cell about twice as long as its stem. Abdominal terga II-VI each with sub-basal white band which narrows dorsally and turns abruptly caudad at lateral margin and there ends near or attached to lateral white spot which is turned dorsomesally; sometimes tergum II without complete band and sometimes with lateral spots only; tergum VII with band broken on each side of median patch; segment VIII largely retracted.

**PUPA.** *Cephalothorax.* Trumpet 3.5 times as long as width at middle; hair 1, 3-C single, longer than 2-C; 2-C single; 4-C single or double; 5, 6-C single; 6-C much stouter and slightly longer than 7-C, 7-C usually double (1-2); 10-C usually with 3-4 branches, mesad and caudad of 11-C; 11-C single. *Abdomen.* Hair 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; hair 1-II usually with 10-11 branches; 2-II mesad of 3-II; 2-IV, V mesad of 1-IV, V; hair 1-III, IV usually double (1-2); 3-II, III single, shorter than segment III; hair 5-IV-VI single, not reaching beyond posterior margin of following segment; hair 9-VII single and barbed or split at tip; hair 9-VIII usually with 2 main stems, barbed, reaching beyond fringe of paddle. *Paddle.* Margins with fringe; hair 1-P single.

**LARVA.** *Head.* Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; inner mouth brushes pectinate at tip; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; hair 5, 6, 8, 9, 10, 13-C single; 7, 12, 15-C usually double; 11-C usually 5-branched (4-5); 14-C usually 3-branched (2-3); mentum with 9-10 teeth on each side. *Thorax.* Hair 1-P 3-branched; 2-P single; 3-P double; 4-P 2-branched; 5, 6-P single; 7-P double; 9-P single; 11-P single; 5, 7-M single; 6-M with 3-4 branches; 8-M 4-branched; 9-M 3-branched; 10, 12-M single, long, stout; 11-M single, small; 7-T usually 5-branched (5-6); 9-T usually double; 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen.* Hair 6-I with 3-4 branches; 7-I single; 6-II 3-branched; 7-II 3-branched; 6-III-V double; 6-VI single; 1-VII usually 3-branched; 2-VII usually 3-branched (2-3); comb of 8-10 scales in single row, each scale with fine denticles or fringes at base of apical spine; pentad hair 2, 4-VIII single; 1-VIII with 3-4 branches; 3-VIII with 5-7 branches; 5-VIII with 3-5 branches; siphon short, about twice as long as wide, acus absent; pecten teeth 9-13, evenly spaced, each tooth with 1 large and occasionally 1 or 2 very small basal denticles; 1-S with 3-4 branches, inserted beyond last tooth and in line with teeth; saddle incomplete; marginal spicules very small and inconspicuous; 1-X 2-branched; 2-X usually 3-branched; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single; no precratal tufts; anal papillae about 2.5 times as long as saddle, sausage-like.

**TYPE DATA.** *Aedes (Stegomyia) paullusi* Stone & Farner, holotype male in U.S. National Museum, Washington, D.C.; type locality: San Antonio, Samar, PHILIPPINE ISLANDS, 6-XII-1944 (J.H. Paullus, 51). Paratypes: 1 male, N'goles, Calicoan Island, Philippine Islands, 27-I-1945 (J.H. Paullus, 103); 1 female, with same data as holotype; 1 female, Baras, Calicoan Island, Philippine Islands, 24-I-1945 (J.H. Paullus, 100); 1 female, small island near Calicoan Island, Philippine Islands, 12-II-1945 (J.H. Paullus, 110); 1 female, Abuyog, Leyte, Philippine Islands, XI-1944 (O.H. Graham) in U.S. National Museum; 2 males (# 6053), Taroena, Sangir Islands, III-1928 (S.L. Brug & de Rook) in British Museum (Natural History), London.

**DISTRIBUTION.** 659 specimens examined: 201♂, 207♀, 104♂ terminalia, 4♀ terminalia, 6 L, 1 l, 1 p, 68 individual rearings (67 l, 68 p).

**PHILIPPINES.** Samar: San Antonio (XII-1944, J.H. Paullus), 3♂, 4♀, 2♂ terminalia; Pintanahon (IV-1945, Rozeboom, Knight & Laffoon), 2♂, 1♂ terminalia, 4 L, 2 individual rearings (2 l, 2 p); Bulusao (V-1945, Rozeboom, Knight & Laffoon), 2♂, 1♀, 2♂ terminalia, 2 individual rearings (2 l, 2 p); Ducong (V-1945, Rozeboom, Knight & Laffoon), 1♀, 1 individual rearing (1 l, 1 p); Osmena (IV-IX-1945, Rozeboom, Knight & Laffoon), 30♂, 27♀, 19♂

terminalia, 21 individual rearings (21 l, 21 p); Tank Farm (IV-1945, Rozeboom, Knight & Laffoon), 1♀; Samar (III-1945, Rozeboom, Knight & Laffoon), 1♂, 1♂ terminalia; Leyte: Abuyog (XI-1944, O.H. Graham), 1♀; Tacloban- (V-IX-1945, H.R. Roberts), 9♂, 27♀, 6♂ terminalia, 6 individual rearings (6 l, 6 p); (V-1945, E.S. Ross), 6♂, 3♀, 3♂ terminalia. Dagami- (VIII-1945, H.R. Roberts), 20♂, 16♀, 19♂ terminalia, 3 individual rearings (3 l, 3 p); (VII-1945, Rozeboom, Knight & Laffoon), 1♀. Palo (V-1945, H.R. Roberts), 1♀; Lagolago Baybay (I-II-1945, H.R. Roberts), 5♂, 2♀, 3♂ terminalia; Mt. Lobi 1000' (VIII-1945, Rozeboom, Knight & Laffoon), 2♂; Carigara (XI-1944, E.S. Ross), 2♂, 2♀; Mahaplag (VII-1964, M. Delfinado), 7♂, 7♀, 5♂ terminalia. Mindoro: San Jose (III-V-1945, E.S. Ross), 4♂, 4♀, 3♂ terminalia; Calicoan: Baras (I-1945, J.H. Paullus), 1♀; (II-1945, J.H. Paullus), 1♀; N'goles (I-1945, J.H. Paullus), 1♂, 1♂ terminalia. Palawan: Irahuan R. (VI-1945, Rozeboom, Knight & Laffoon), 3♀, 1 individual rearing (1 l, 1 p); Puerto Princesa (VI-1945, Roseboom, Knight & Laffoon), 1♂; Quezon (XII-1967-II-1968, Alcasid's team), 2♀; Iwahig (XI-1968, Mantubig), 2♀, 2 individual rearings (1 l, 2 p); Balabac I., Cape Melville (VI-1945, Rozeboom, Knight & Laffoon), 1♀. Mindanao: Lanao- Dapau, Porque R. (IV-1931, W.V. King), 2♂, 4♀, 1♂ terminalia; Kolambugan, Titunod (V-1931, W.V. King), 6♂, 4♀, 3♂ terminalia. San Ramon (IX-XI-1945, Rozeboom, Knight & Laffoon), 3♂, 11♀, 1♂ terminalia, 9 individual rearings (9 l, 9 p); Pasanonco (IX-1945, Rozeboom, Knight & Laffoon), 2♂, 5♀, 4 individual rearings (4 l, 4 p); Parang (VI-1945, J.H. Paullus), 2♂, 4♀; Kabakan (V-1945, R. Staples), 13♂, 9♂ terminalia; (V-XI-1945), 4♂, 7♀; (1945, Rozeboom, Knight & Laffoon), 3♂, 6♀; Jolo Jolo I. (IX-1945, Rozeboom, Knight & Laffoon), 2♂, 1♀, 1 individual rearing (1 l, 1 p); Philippine Islands (V-1945), 2♂, 3♀; (V-1946), 8♂, 8♀, 7♂ terminalia, 4♀ terminalia; (VI-1945, Rozeboom, Knight & Laffoon), 1♂.

**MALAYSIA.** *West Malaysia:* Selangor- 15 ml. Ulu Gombak (III-IV-1959, W.W. MacDonald), 5♂, 7♀, 5♂ terminalia, 10 individual rearings (10 l, 10 p); Ulu Gombak 16 (XI-1965, Ramalingam's team), 1 L; Bt. Kutu (V-1968, Ramalingam's team), 1♀; Pahang- Gunong Benom (IX-1968, Ramalingam), 1♂, 7♀, 1♂ terminalia, 1 L, 2 individual rearings (2 l, 2 p). *East Malaysia:* Sabah- Kudat (VI-VIII-1966, F.Y. Cheng), 2♀; Balembangan Is., Kok Simpul (X-1965, F.Y. Cheng), 2♂, 1♀, 2♂ terminalia, 1 L, 1 p, 1 individual rearing (1 l, 1 p).

**INDONESIA.** *Sangir Islands:* Taroena (III-1928, S.L. Brug & de Rook), 11♂, 4♀, 2♂ terminalia; (27-I-1942), 18♂, 9♀, 1♂ terminalia. *Celebes:* Lindoemeer (II-1937, Brug & Tesch), 2♂, 2♀, 1♂ terminalia; Halino (VI-1937, Brug), 2♂, 2♀; Kalawara (I-II-1937, Brug), 4♂, 5♀, 2♂ terminalia; Kabaena- (V-1935, Brug), 3♂, 1♂ terminalia; (VI-1937, Brug), 1♀. *Ambon Island-* (27-I-1938), 7♂, 4♀; Waai (XII-1965-1966, A.M.R. Wagoner), 3♂, 1♀, 3♂ terminalia, 3 individual rearings (3 l, 3 p).

**TAXONOMIC DISCUSSION.** *A. paullusi* is a member of the *scutellaris* subgroup. The adult is very similar to *alorensis* in having the mid femur with a median white line on anterior surface and wing with minute basal spot of white scales on costa. It can easily be separated from *alorensis* by having a few narrow white scales on lateral prescutal area and on scutal angle area; in *alorensis* there are no such scales. When scutal markings are rubbed off, *paullusi* can easily be mistaken for *alorensis* but can still be recognized by the characteristic abdominal bandings.

The male terminalia of *paullusi* have the claspette truncate, with the apical surface distinctly oval in shape, bearing numerous setae and several long, stout ones on tergal side and with 4 spine-like setae on sternal side, thus differing from all other species that have been described in this group.

The larva of *paullusi* is very similar to *alcasidi*, *malayensis*, *riversi* and *scutellaris* but can be distinguished from them by having hair 2-X 3- branched, 2-VII usually with 3 (2-3) branches; pecten tooth with 1 large and occasionally



1 or 2 very small basal denticles; in *alcasidi*, *malayensis*, *riversi* and *scutellaris* hair 2-X 2-branched, 2-VII usually single (1-2). The pupa of *paullusi* resembles *alcasidi* and *scutellaris* but can be separated from both by having hair 6-C usually slightly longer than 7-C, hair 1-II usually with 10-11 branches, which rise from a common stem at base, paddle margins with fringe extending close to base and occupying more than apical 3/4 of paddle; in *alcasidi* and *scutellaris* hair 6-C usually about as long as 7-C, hair 1-II branched, usually without a distinct common stem at base, paddle margins with fringe on less than apical 3/4 of paddle.

*A. paullusi* is apparently a common species in the Indomalayan area and extends into the western fringe of the Papuan area. It is presently known from the Philippines, Sangi Islands, Taroena, Celebes, Kabaena, Sabah, W. Malaysia and Ambon.

**BIOLOGY.** The immature stages of *paullusi* have been found mainly in rock holes, coconut shells, coconut husks, coconut fronds and bamboo stumps in the Philippines. It has also been found in a tree hole, a hole in a log and in a fallen abaca leaf in the Philippines. The immature stages were found in a small artificial container in rainforest in Pahang, Malaysia. The specimens from Lindoemeer, Celebes were found in bamboo stumps and those from Waai, Ambon Island in coconut shells. The adult females have been taken biting buffalo in a village in Kudat, Sabah

#### *AEDES (STEGOMYIA) RIVERSI* BOHART & INGRAM

(Figs. 26A, B, claspette; 31A, B, E, G, H, ♀ abdomen, hind leg, ♂ abdomen; 32, ♂ terminalia, pupa; 33, larva)

*Aedes (Stegomyia) riversi* Bohart & Ingram 1946, J. Wash. Acad. Sci. 36: 50 (♂\*, ♀, L\*); Bohart & Ingram 1946, U.S. Navmed 1055 :65 (♂\*, ♀, P\*, L\*); Marks 1954, Bull. Br. Mus. (nat. Hist.) Ent. 3(10): 383, Pl. 18 (♂\*, ♀\*).

**MALE. Head.** Proboscis dark scaled, with pale scales on ventral side, longer than fore femur; palpus dark, slightly shorter than proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned and with only a few short hairs; antenna plumose, shorter than proboscis. **Thorax.** Scutum with narrow dark scales and prominent median stripe of similar white ones; stripe narrows slightly posteriorly and forks at beginning of prescutellar space; on each side a posterior dorsocentral yellowish line which does not reach to middle of scutum; a supraalar line of broad white scales present; posterior pronotum with narrow dark scales on upper portion and with broad white scales on lower portion forming a white stripe instead of a white patch; post-spiracular area without scales; subspiracular area without scales; lower mesepimeral scale patch large and connected to upper mesepimeral scale patch. **Wing.** Dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.5 times as long as its stem. **Halter.** With dark scales. **Legs.** Fore and mid femora dark anteriorly, paler posteriorly; hind femur anteriorly with broad white stripe which widens at base and is separated from apical white scale patch; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomere is 1/5, 1/4, 2/5 and 2/3, tarsomere 5 all white or sometimes with a few dark scales on apical ventral side. **Abdomen.** Abdominal segment I with white scales on laterotergite; tergum II dark dorsally, with lateral white spots only; tergum III dark dorsally, with lateral white spots only or sometimes with median spot as well; terga IV-VI each with sub-basal white band which is rather narrow

and is connected to the large lateral spots which are turned dorsomesally, sometimes terga IV-VI each with sub-basal narrow band at middle or with median spot and with lateral spots which are turned dorsomesally, or sometimes terga IV-VI dark at middle with lateral spots which are turned dorsomesally as in the form of incomplete bands; tergum VII with lateral white spots only; sternum VIII largely covered with white scales. *Terminalia*. Basimere 3.5 times as long as wide; with a patch of hairs on basomesal area of dorsal surface; mesal surface membranous; claspette simple, with distal expanded part subtriangular in shape, sternal and tergal sides not parallel but tapering, with 6-8 modified setae on center of sternal side, closer to sternal angle area than to apicotergal angle area and occupying about 2/5 of it; distimere simple, elongate, as long as basimere, with a spiniform process and a few hairs near apex; tergum IX with middle rounded and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on apical half. Wing with first forked cell about twice as long as its stem. Abdominal terga II-III always dark dorsally, with lateral white spots only; tergum IV with incomplete sub-basal band only or sometimes with small median spot as well; terga V-VII each with sub-basal white band which is rather narrow and is connected to lateral spots which are turned dorsomesally, sometimes terga V-VII without complete bands or sometimes terga V-VII with incomplete sub-basal bands only; segment VIII largely retracted.

**PUPA.** *Cephalothorax*. Trumpet 3 times as long as width at middle; hair 1, 3-C single, longer than 2-C; 2-C single; 4-C usually double; 5-C double; 6-C single, much stouter than 7-C, slightly shorter than 7-C; 7-C usually single (1-2); 10-C usually with 2-4 branches, mesad and caudad of 11-C; 11-C single. *Abdomen*. Hair 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; hair 1-II usually with 7-12 branches; 2-II mesad of 3-II; hair 2-IV, V mesad of 1-IV, V; 1-III usually double (2-6); 1-IV usually double (1-2); hair 3-II, III single, shorter than segment III; hair 5-IV-VI single, not reaching beyond posterior margin of following segment; 9-VII single, simple; 9-VIII usually with 2 main stems (1-2), barbed, reaching beyond fringe of paddle. *Paddle*. Margins with fringe; hair 1-P single.

**LARVA.** *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; inner mouth brushes pectinate at tip; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; hair 5, 6, 8, 9, 10, 13-C single; 7, 12, 14-C usually double; 11-C usually with 3-4 branches; mentum with 11-12 teeth on each side.

*Thorax*. Hair 1-P with 2-3 branches; 2-P single; 3-P double; 4-P 2-branched; 5, 6-P single; 7-P double; 9-P single; 11-P single; 5, 7-M single; 6-M 3-branched; 8-M 5-branched; 9-M 3-branched; 10, 12-M single, long, stout; 11-M single, small; 7-T with 4-5 branches; 9-T usually double; 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen*. Hair 6-I 3-branched; 7-I single; 6-II with 2-3 branches; 7-II double; 6-III-V double; 6-VI single; 1-VII usually with 2-3 branches; 2-VII single; comb of 10-14 scales in a single row, each scale with fine denticles or fringes at base of apical spine; comb scales often with apical spine split at tip; sometimes 2-4 comb scales connected at base; pentad hair 2, 4-VIII single; 1, 5-VIII with 3-4 branches; 3-VIII with 5-7 branches; siphon short, about twice as long as wide, acus absent; pecten teeth 10-21 in number, evenly spaced, each tooth with 1 large and 1-2 small basal denticles; 1-S with 3-4 branches, inserted beyond last tooth and beyond middle of siphon; saddle incomplete; marginal spicules very small and inconspicuous; 1-X 2-branched; 2-X 2-branched; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single except 2 proximal ones usually double (1-2); no precratal tufts; anal papillae about twice as long as saddle, sausage-like.

**TYPE DATA.** *Aedes (Stegomyia) riversi* Bohart & Ingram, holotype male in U.S. National Museum, Washington, D.C.; type locality: Chizuka, Okinawa (RYUKYU-RETTO), IX-1945 (R. Bohart & R. Ingram). Paratypes (except as indicated, all collected by R. Bohart & R. Ingram): 6 males, 9 females, Chizuka, Okinawa, IX-1945; 1 male, 3 females, Chizuka, Okinawa, IX-6-1945; 2 females, Chizuka, Okinawa, VIII-24-1945; 2 males, 1 female, Chizuka, Okinawa, VIII-1945; 1 male, 6 females, Hentona, Okinawa, IX-1945 (C.L. Harnage); 3 males, 2 females, Hentona, Okinawa, IX-1945; 1 male, 5 females, Shana Wan, Okinawa, IX-1945; 1 female, Shana Wan, Okinawa, IX-4-1945 in U.S. National Museum; 1 female, Chizuka, Okinawa, IX-1945 in British Museum (Natural History), London. Also paratype larvae: 6 larvae on 3 slides, Chizuka, Okinawa, VIII-IX-1945; 4 larvae on 2 slides, Shana Wan, Okinawa, IX-13-1945 in U.S. National Museum.

**DISTRIBUTION.** 807 specimens examined: 91♂, 213♀, 65♂ terminalia, 9♀ terminalia, 35 L, 197 individual rearings (197 l, 197 p).

**RYUKYU ISLANDS.** Okinawa: Chizuka (VIII-IX-1945, R. Bohart & R. Ingram), 10♂, 20♀, 8♂ terminalia, 6 L; Hentona (IX-1945, C.L. Harnage) 4♂, 9♀, 2♂ terminalia; (IX-1945, R. Bohart & R. Ingram), 4♂, 2♀, 3♂ terminalia; Shana Wan (IX-1945, R. Bohart & R. Ingram), 2♂, 6♀, 1♂ terminalia, 4 L; *Iriomote*: Shirahama (V-1968, A.B. Silagan), 2♀, 2 individual rearings (2 l, 2 p); 15 ml. N. of Ohara Village (XII-1968, M. Nakama), 2♀, 2 individual rearings (2 l, 2 p); 2 ml. W. of Yabu Village (XII-1968, M. Nakama), 2♂, 12♀, 1♂ terminalia, 14 individual rearings (14 l, 14 p); (XII-1968, A.B. Silagan), 4♂, 2♀, 3♂ terminalia, 6 individual rearings (6 l, 6 p); 2 ml. S. of Yabu (XII-1968, M. Nakama), 1♂, 2♀, 1♂ terminalia; Komi (II-1970, I.V. Villanueva), 1♂, 3♀, 4 individual rearings (4 l, 4 p); *Yaeyama*: Kabira (X-1968, G. Takaesu), 2♀, 2 individual rearings (2 l, 2 p); (X-1968; A.B. Silagan), 3♂, 8♀, 2♂ terminalia, 11 individual rearings (11 l, 11 p); Yarabu Lake (X-1968, G. Takaesu), 4♂, 14♀, 2♂ terminalia, 18 individual rearings (18 l, 18 p); (X-XII-1968, A.B. Silagan), 5♂, 25♀, 2♂ terminalia, 30 individual rearings (30 l, 30 p); Haskino (X-1968, G. Takaesu), 11♀, 11 individual rearings (11 l, 11 p); Inota (X-1968, G. Takaesu), 4♀, 4 individual rearings (4 l, 4 p); (XII-1968, A.B. Silagan), 2♂, 1♀, 2♂ terminalia, 3 individual rearings (3 l, 3 p); (XII-1968, M. Nakama), 1♀, 1 individual rearing (1 l, 1 p); *Ishigaki*-Yarabu Lake (I-1970, I.D. Cocklin), 1♂, 2♀, 1♂ terminalia, 3 individual rearings (3 l, 3 p); (I-1970, I.V. Villanueva), 3♂, 7♀, 3♂ terminalia, 10 individual rearings (10 l, 10 p); (I-1970, T.S. Bolingust), 9♂, 21♀, 7♂ terminalia, 30 individual rearings (30 l, 30 p); (I-1970, A.B. Comp), 2♀, 2 individual rearings (2 l, 2 p); Inota III (I-1970, I.V. Villanueva), 8♂, 13♀, 6♂ terminalia, 21 individual rearings (21 l, 21 p); (I-1970, T. S. Bolingust), 3♂, 3♀, 6 individual rearings (6 l, 6 p); 5 ml. N. of Arakawa (I-1970, I.V. Villanueva), 1♀, 1 individual rearing (1 l, 1 p); Shirako (I-1970, T.S. Bolingust), 4♂, 12♀, 4♂ terminalia, 9♀ terminalia, 16 individual rearings (16 l, 16 p); *Yaeyama* (I-1970), 25 L. *Ishigaki-Jima*: (X-XI-1961, Sasa), 9♂, 22♀, 6♂ terminalia. *Amami*: (V-1962, Sasa), 12♂, 4♀, 11♂ terminalia.

**TAXONOMIC DISCUSSION.** *A. riversi* is a member of the *scutellaris* subgroup. The adult is very similar to *alcasidi*, *malayensis* and *scutellaris* in having the mid femur without median white line on anterior surface, wing with minute basal spot of white scales on costa and hind tarsomere 5 all white. It is closer to *malayensis* than to *alcasidi* and *scutellaris* in having hind tarsomere 3 with basal 2/5 white banded and hind tarsomere 4 with basal 2/3 white banded. It can be separated from *malayensis* by having hind tarsomere 1 with basal 1/5 white banded and hind tarsomere 2 with basal 1/4 white banded; in *malayensis* hind tarsomere 1 has basal 1/4 white banded and hind tarsomere 2 with basal 1/3 white banded.

The male terminalia of *riversi* are very similar to *alcasidi*, *malayensis* and *hensilli* in having claspette with distal expanded part subtriangular

in shape in lateral aspect (dissected claspette), sternal and tergal sides not parallel but tapering and without apicosternal angle. It is closer to *malayensis* than to *alcasidi* and *hensilli* in having apicotergal area of claspette without distinctly long setae. It can be separated from *malayensis* by having the claspette with 6-8 modified setae on center of the sternal side, closer to sternal angle area than to apicotergal angle area and occupying about 2/5 of it; in *malayensis* the claspette has 7-10 modified setae forming a prominent row on center of sternal side and occupying 1/2 of it.

The larva of *riversi* resembles *albopictus*, *alcasidi*, *malayensis* and *scutellaris* in having no siphon acus, saddle incomplete, hair 2-X 2-branched and 2-VII usually single (1-2). It can be separated from them by having hair 1-VII with 2-3 branches, siphon about twice as long as wide, pecten teeth 10-21, closely arranged in a line, hair 1-S usually inserted beyond middle of siphon and comb scales sometimes with apical spine split at tip. The pupa of *riversi* is very similar to *albopictus*, *pseudalbopictus*, *alcasidi*, *malayensis* and *scutellaris* in having hair 9-VI about same thickness as 9-V, less than twice as long as 9-V, hair 9-VII single and simple, hair 9-VIII reaching beyond fringe of paddle. It is closer to *malayensis* than to any other species in having hair 6-C much stouter than 7-C and about 3/4 as long as 7-C. It can be separated from *malayensis* by having hair 9-VIII usually with 2 main stems (1-2), barbed, reaching beyond fringe of paddle, hair 1-II with very few secondary branches; in *malayensis* hair 9-VIII usually with a strong main stem (1-2) and lateral branches of varying length, hair 1-II with many primary and secondary branches.

*A. riversi* is apparently restricted to the Ryukyu Islands. The immature stages are often found in association with *albopictus* and *downsi* in the field. Great care must be taken in identifying them. The larva and pupa of *riversi* can be separated from *albopictus* by the diagnostic characters mentioned under the discussion of *albopictus*. The immature stages are markedly different from *downsi*. The larva of *riversi* can be separated from *downsi* by having hair 1-VII usually with 2 (2-3) branches, long, at least 2.5 times as long as 5-VII and hair 2-VII usually single; in *downsi* hair 1-VII usually has 4 branches which are short and less than twice as long as 5-VII and hair 2-VII 3-branched. The pupa of *riversi* can easily be distinguished from *downsi* by having hair 9-VI slender, about same thickness as 9-V, less than twice as long as 9-V, single, simple and hair 9-VII single and simple; in *downsi* hair 9-VI stout, much stouter than 9-V, at least twice as long as 9-V, usually single and barbed, hair 9-VII usually single and barbed or with 2 branches at tip.

**BIOLOGY.** The larvae of *riversi* have been found mainly in rock holes, tree holes and cut bamboo in Okinawa. The immature stages from Ryukyu Islands, Yaeyama and Iriomote were found mainly in tree holes. The specimens from Ishigaki-Jima were found in tree holes and rock holes. The immature stages were associated with *albopictus* and *downsi*. The adult females have been taken biting man in Okinawa.

#### *AEDES (STEGOMYIA) SCUTELLARIS* (WALKER)

(Figs. 25A, B, claspette; 31 F, hind leg; 34, ♂; 35, ♂ terminalia, pupa; 36, larva)

*Culex variegatus* Doleschall 1858, (non Schrank, 1781), Nat. Tijd. Ned.-Ind. 17: 77 (A).

*Culex scutellaris* Walker 1859, Proc. Linn. Soc. Lond. 3: 77 (♀).

*Culex zonatipes* Walker 1861, Proc. Linn. Soc. Lond. 5: 229 (♀).

*Aedes (Stegomyia) scutellaris* (Walker), Edwards 1932, Genera Insectorum, Fasc. 194 :165 (synonymized *Culex variegatus* and *Culex zonatipes*);

Taylor 1934, Proc. Linn. Soc. N.S.W. 59:235; Stone 1947, Proc. ent. Soc. Wash. 49(3): 85; Penn 1949, Pacif. Sci. 3: 56 (P\*); Marks 1954, Bull. Br. Mus. (nat. Hist.) Ent. 3(10): 383, Pl. 18 ( $\sigma^*$ ,  $\varphi^*$ ); Bonne-Wepster 1954, Spec. Publ. R. trop. Inst. Amsterdam 111: 79 ( $\sigma$ ,  $\varphi^*$ , L\*); Belkin 1962, Mosq. South Pacific, Vol. I: 474-475 & Vol. II: 331 ( $\sigma^*$ ,  $\varphi$ ); Huang 1969, Proc. ent. Soc. Wash. 71(4): 472 ( $\sigma^*$ ) (topotypic  $\sigma$ ).  
*Aedes (Stegomyia) scutellaris scutellaris* (Walker), Colless 1962, Proc. Linn. Soc. N.S.W. 87: 313 ( $\sigma^*$ ,  $\varphi$ ) (to ssp. status).

**MALE.** *Head.* Proboscis dark scaled, slightly longer than fore femur; palpus dark, as long as proboscis, with white basal band on each of segments 2-5; those on segments 4-5 incomplete dorsally; segments 4-5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, shorter than proboscis. *Thorax.* Scutum with narrow dark scales and prominent median stripe of similar white ones; stripe narrows slightly posteriorly and forks at beginning of prescutellar space; on each side a posterior dorsocentral pale yellowish line which does not reach to middle of scutum; a supralar line of broad white scales present; posterior pronotum with narrow dark scales on upper portion and with broad white scales on lower portion forming a white stripe instead of a white patch; postspiracular area without scales; subspiracular area with or without scales; mesepimeral scale patches narrowly connected, sometimes well separated. *Wing.* Dark scales on all veins except for minute basal spot of white scales on costa; first forked cell 1.5 times as long as its stem. *Halter.* With dark scales. *Legs.* Fore and mid femora dark anteriorly, paler posteriorly; hind femur anteriorly with broad white stripe which widens at base and is separated from apical white scale patch; fore and mid tarsi with basal white bands on tarsomeres 1-2; hind tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to total length of tarsomeres is 1/3, 2/5, 1/2 and 3/4, tarsomere 5 all white. *Abdomen.* Abdominal segment I with white scales on laterotergite; tergum II always dark dorsally, with lateral white spots only; terga III-VI each with sub-basal white band which is connected to lateral spots, sometimes tergum III with sub-basal median spot and with lateral spots which are turned dorsomesally; tergum VII with lateral white spots only; sternum VIII largely covered with white scales. *Terminalia.* Basimere 3.5 times as long as wide; with patch of hairs on basomesal area of dorsal surface; mesal surface membranous; claspette simple, with distal expanded part square in shape, sternal and tergal sides more or less parallel, apicosternal angle present and with 5 or 6 modified setae close to apicosternal angle area; distimere simple, elongate, as long as basimere, with a spiniform process and a few hairs near apex; tergum IX with middle rounded and with a hairy lobe on each side.

**FEMALE.** Essentially as in male, differing in the following respects: palpus 0.2 length of proboscis, with white scales on apical half. Wing with first forked cell about twice as long as its stem. Abdominal terga II-III always dark dorsally, with lateral white spots which are turned dorsomesally; sometimes tergum III with sub-basal median spot as well; terga IV-VII each often with sub-basal white band which is connected to lateral spots or sometimes tergum IV with sub-basal median spot and with lateral spots which are turned dorsomesally; or sometimes tergum IV with incomplete sub-basal band only; segment VIII entirely retracted.

**PUPA.** *Cephalothorax.* Trumpet 3.5 times as long as width at middle; hair 1, 3-C single, longer than 2-C; 2-C usually double (1-2); 4-C usually double (1-2); 5-C usually 2-branched (2-3); 6-C single, much stouter than 7-C, about as long as 7-C; 7-C usually double (1-2); 10-C usually with 2-4 branches, mesad and caudad of 11-C; 11-C single. *Abdomen.* Hair 1-I well

developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; 1-II usually with 7-9 branches; hair 2-IV, V mesad of 1-IV, V; 1-III usually with 2-6 branches; 1-IV usually double (2-3); hair 3-II, III single, shorter than segment III; 5-IV-VI single, not reaching beyond posterior margin of following segment; 9-VII single, simple or split at tip; 9-VIII usually with 2 main stems (2-3) and barbed, reaching beyond fringe of paddle. *Pad-dle*. Margins with fringe; hair 1-P single.

**LARVA.** *Head.* Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; inner mouth brushes pectinate at tip; head hair 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; hair 5, 6, 8, 9, 10, 13-C single; 7, 11-C usually with 2-3 branches; 12, 14-C double; 15-C usually 3-branched (2-3); mentum with 11-12 teeth on each side. *Thorax.* Hair 1-P usually 3-branched (2-3); 2-P single; 3-P double; 4-P 2-branched; 5, 6-P single; 7-P double; 9-P single; 11-P usually single (1-2); 5, 7-M single; 6-M 3-branched; 8-M with 4-5 branches; 9-M 3-branched; 10, 12-M single, long, stout; 11-M single, small; 7-T usually 5-branched (5-6); 9-T usually double (2-3); 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen.* Hair 6-I usually 4-branched (3-4); 7-I single; 6-II usually 3-branched; 7-II usually with 2-3 branches; 6-III-V double; 6-VI single; 1-VII usually 2-branched (2-3), long; 2-VII usually single; comb of 9-12 scales in a single row, each scale with fine denticles or fringes at base of apical spine; pentad hair 2-VIII distant from 1-VIII; 1, 5-VIII 3-branched; 3-VIII with 5-6 branches; 2, 4-VIII single; siphon about 2.5 times as long as wide, acus absent; pecten teeth 11-12 in number, evenly spaced, each tooth with 1-3 basal denticles; 1-S with 3-4 branches, inserted beyond last tooth and usually before middle of siphon; saddle incomplete; marginal spicules very small and inconspicuous; 1-X 2-branched; 2-X 2-branched; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single except 1 or 2 proximal ones usually double (2-3); no precratal tufts; anal papillae 2.5 times as long as saddle, sausage-like.

**TYPE DATA.** *Culex scutellaris* Walker, type female in British Museum (Natural History), London; type locality: *ARU (AROE) ISLANDS*. *Culex zonatipes* Walker, type female in British Museum (Natural History); type locality: Dorey, NEW GUINEA.

**DISTRIBUTION.** 163 specimens examined: 56♂, 24♀, 40♂ terminalia, 4♀ terminalia, 31 individual rearings (8 l, 31 p).

**INDONESIA.** *Moluccas: Aru (Aroe) Islands*, 1♀; *Aroe Islands*, Dobo (23-I-1932, Brug & de Rook), 1♂, 2♂ terminalia; *Ceram-Sawaai* (XII-1931, Brug & de Rook), 2♂; *Nhust Sawai* (VII-1931, Brug & de Rook), 2♂, 2♂ terminalia; *Ambon I.*, Waai (1966, A.M.R. Wagner), 10♂, 2♀, 10♂ terminalia, 2♀ terminalia, 11 individual rearings (3 l, 11 p); *West New Guinea-Dorey*, 1♀; *Fak Fak* (I-1932, Brug & de Rook), 1♂, 1♂ terminalia; *Cyclops Mt. Sobron* 930 ft. (V-VI-1936, L.E. Cheesman), 1♂, 2♀, 1♂ terminalia; *Cyclops* 1000 ft. (III-1945, Rozeboom, Knight & Laffoon), 2♂, 2♂ terminalia; *Bougainville Bay* (I-1945, Knight), 1♂, 1♂ terminalia; *Hollandia* (1962, ex Lab. Colony, Colless), 2♂, 2♂ terminalia.

**NEW GUINEA.** *Goodenough Is.* (VI-1944, E.S. Ross), 1♂, 1♂ terminalia; *Tanah Merah Road* (II-1945, Schultz & Rozeboom), 3♀; *Lake Sentani* (III-1945, Schultz), 1♂, 1♂ terminalia; *New Guinea NE, Alexishafen* (1944, Johnson), 4♂, 2♀, 4♂ terminalia; (XI-1964, W.A. Steffan), 20♂, 8♀, 5♂ terminalia, 13 individual rearings (3 l, 13 p); *Lae, Botanical Garden*, 5-10 m. (IV-1965, W.A. Steffan), 1♂, 2♀, 1♂ terminalia, 1♀ terminalia, 2 individual rearings (2 p); *Oomsis*, 24 km. W. Lae (IV-1965, W.A. Steffan), 1♂, 1♂ terminalia; *Kaisinik*, 1000 m. (IV-1965, M. Sedlacek), 1♀, 1 individual rearing (1 l, 1 p); *Madang*, 0-5 m. (XI-1964, W.A. Steffan), 5♂, 2♀, 5♂ terminalia, 1♀ terminalia, 3 individual rearings (1 l, 3 p); *New Guinea, SE, Cape Killerton* 0-5 m. (V-1965, W.A. Steffan), 1♂, 1♂ terminalia, 1 individual rearing (1 p).

**TAXONOMIC DISCUSSION.** *A. scutellaris* is a Papuan species of the *scutellaris* subgroup. The adult is very similar to *alcasidi*, *malayensis* and *riversi* in having the mid femur without a median white line on anterior surface, wing with minute basal spot of white scales on costa, hind tarsomere 5 all white. The adult of *scutellaris* cannot be separated from *alcasidi* except by the male terminalia but can be separated from *malayensis* and *riversi* in having hind tarsomere 3 with basal  $1/2$  white banded and hind tarsomere 4 with basal  $3/4$  white banded; in *malayensis* and *riversi* hind tarsomere 3 has basal  $2/5$  white banded and hind tarsomere 4 has basal  $2/3$  white banded.

The male terminalia of *scutellaris* are very similar to *andrewsi* in having claspette with distal expanded part square in shape in lateral aspect (dissected claspette), sternal and tergal sides more or less parallel and apicosternal angle present. It differs from *andrewsi* in having claspette with 5 or 6 modified setae, set on a prominence, close to apicosternal angle area and being without several distinctly long and stout setae on apicotergal area; in *andrewsi* the claspette has 4 or 5 modified setae in a row on apicosternal angle and several distinctly long and stout setae on apicotergal area.

The larva of *scutellaris* resembles *albopictus*, *alcasidi*, *malayensis* and *riversi*, but is closer to *alcasidi* and *malayensis* in having hair 1-VII usually with 2 long branches (2-3), when 3-branched then one much smaller than the other two, siphon about 2.5 times as long as wide, pecten teeth 10-16 and 1-S inserted at middle or before middle of siphon. It is indistinguishable from *alcasidi* and can only be separated from *malayensis* by the diagnostic characters mentioned under the discussion of that species.

The pupa of *scutellaris* is very similar to *albopictus*, *pseudalbopictus*, *alcasidi*, *malayensis* and *riversi* in having hair 9-VI about same magnitude as 9-V, 9-VII single and simple, 9-VIII reaching beyond fringe of paddle. It is closer to *alcasidi*, *malayensis* and *riversi* in having hair 6-C about  $3/4$  length of 7-C to about as long as 7-C. The pupa is indistinguishable from *alcasidi* and can be separated from *malayensis* and *riversi* by the diagnostic characters mentioned in the Key.

Although the immature stages of *scutellaris* are so similar to *alcasidi* the male terminalia are markedly different by having the claspette with distal expanded part square in shape in lateral aspect (dissected claspette), sternal and tergal sides more or less parallel and apicosternal angle present; in *alcasidi* claspette with distal expanded part subtriangular in shape in lateral aspect (dissected claspette), sternal and tergal sides not parallel but tapering and without apicosternal angle.

*A. scutellaris* is a Papuan, *alcasidi* a Philippine, *hensilli* a Micronesian, *malayensis* a Southeast Asian and *riversi* a Ryukyu species. All of them are extremely variable and difficult to separate in all stages except for the male terminalia. The diagnostic characters are summarized in Table II.

*A. scutellaris* is apparently restricted to the East of Lee & Woodhill's Line. It is presently known from Ceram, Ambon, Aru Islands and New Guinea in the Papuan area.

**BIOLOGY.** The immature stages of *scutellaris* have been collected from coconut shells and artificial containers.

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TABLE II. CHARACTERS FOR SEPARATING SOME SPECIES CLOSELY RELATED TO *AEDES (STEGOMYIA) SCUTELLARIS* (WALKER)

| Diagnostic Characters  | Species         |                 |                   |                |                    |
|--|-----------------|-----------------|-------------------|----------------|--------------------|
|  | <i>alcasidi</i> | <i>hensilli</i> | <i>malayensis</i> | <i>riversi</i> | <i>scutellaris</i> |
| Hind tarsomere 4 with more than basal 0.7 white                            | X               | -               | -                 | -              | X                  |
| Hind tarsomere 5 with apical half all dark                                 | -               | X               | -                 | -              | -                  |
| Claspette with sternal and tergal sides parallel                           | -               | -               | -                 | -              | X                  |
| Apicosternal angle present   | -               | -               | -                 | -              | X                  |
| Apicotergal area of claspette with several distinctly long setae           | X               | X               | -                 | -              | -                  |
| Modified setae on the sternal side   | X               | X               | X                 | X              | -                  |
| Modified setae closer to sternal angle area than to apicotergal angle area | -               | -               | -                 | X              | -                  |
| Modified setae set on a prominence   | -               | X               | -                 | -              | X                  |
| Modified setae usually more than 7 in number, forming a prominent row      | -               | -               | X                 | -              | -                  |
| Modified setae occupy less than half of the sternal side                   | X               | X               | -                 | X              | -                  |
| Main geographical distribution   | Philippines     | Micro-nesia     | Southeast Asia    | Ryukyus        | Papua              |

X = Has the character

- = Does not have the character



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APPENDIX I. PRESENT STATUS OF THE *AEDES (STEGOMYIA)*  
*SCUTELLARIS* GROUP OF SPECIES IN SOUTHEAST ASIA

| SPECIES                | STAGES |    |    |    |   | BIOLOGY                                       |
|------------------------|--------|----|----|----|---|---|
|                        | A      |    | P  | L  | E |   |
|                        | ♂      | ♀  |    |    |   |   |
| ALBOPICTUS SUBGROUP    |        |    |    |    |   |   |
| <i>albopictus</i>      | X*     | X* | X* | X* | - | Larval habitats known<br>Female bites man     |
| <i>downsi</i>          | X*     | X* | X* | X* | - | Larval habitats known<br>Female bites man     |
| <i>novalbopictus</i>   | X*     | -  | X* | X* | - | Larval habitats known                         |
| <i>patriciae</i>       | X*     | X* | X* | X* | - | Larval habitats known                         |
| <i>pseudalbopictus</i> | X*     | X* | X* | X* | - | Larval habitats known                         |
| <i>seatoi</i>          | X*     | X  | X* | X* | - | Larval habitats known<br>Female bites man     |
| <i>subalbopictus**</i> | X*     | X* | X* | X* | - | Larval habitats known                         |
| SCUTELLARIS SUBGROUP   |        |    |    |    |   |   |
| <i>alcasidi</i>        | X*     | X* | X* | X* | - | Larval habitats known                         |
| <i>alorensis</i>       | X*     | X* | -  | -  | - | Unknown                                       |
| <i>andrewsi</i>        | X*     | X* | -  | -  | - | Unknown                                       |
| <i>malayensis</i>      | X*     | X* | X* | X* | - | Larval habitats known<br>Female bites man     |
| <i>paullusi</i>        | X*     | X* | X* | X* | - | Larval habitats known<br>Female bites buffalo |
| <i>riversi</i>         | X*     | X* | X* | X* | - | Larval habitats known<br>Female bites man     |

X\* = Stage or sex described and illustrated.

- = Stage or sex unknown.

X = Stage or sex described.

\*\* = Species may also be present in Southeast Asia.



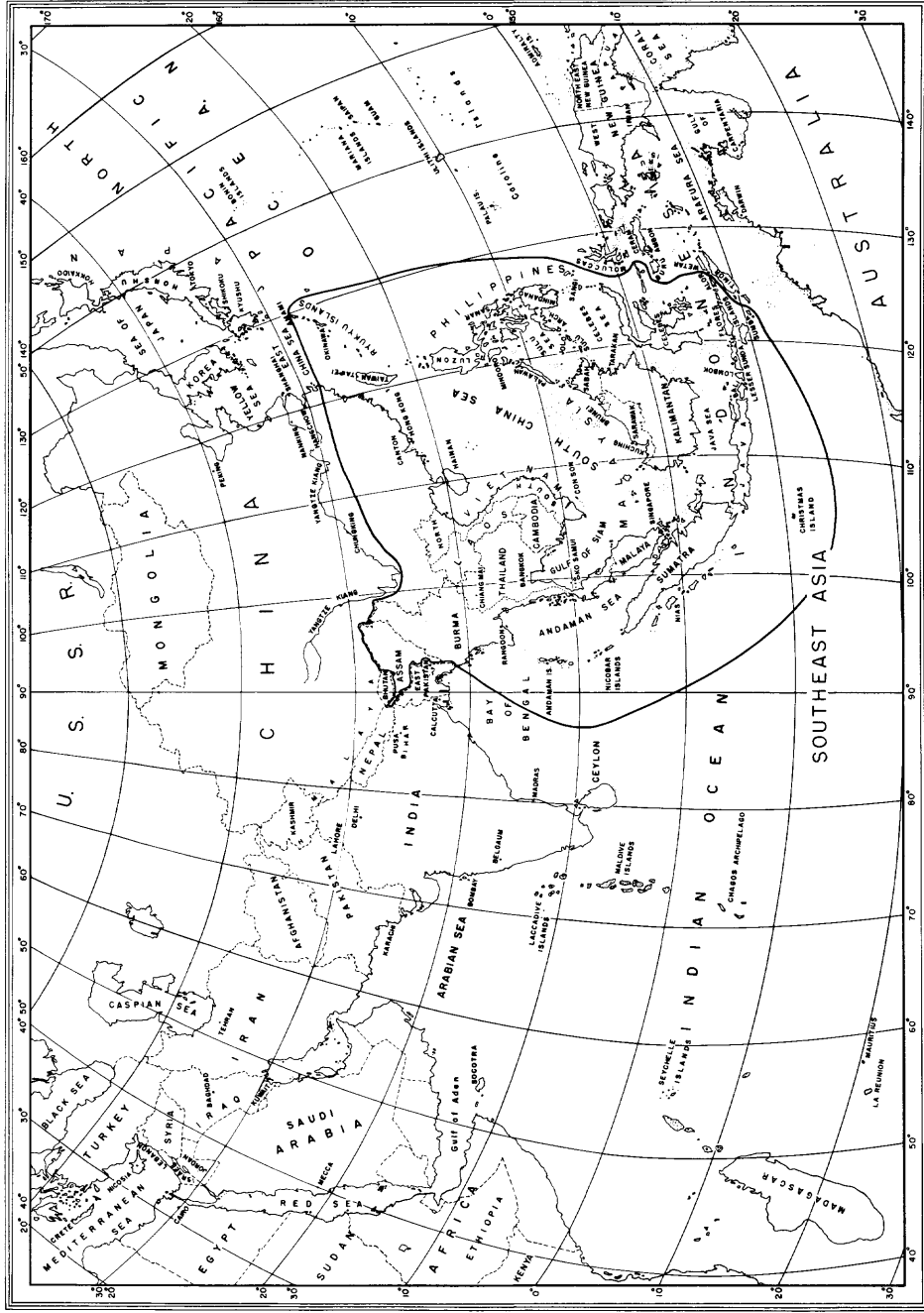
## APPENDIX II. DISTRIBUTION LIST OF THE SOUTHEAST ASIAN SPECIES

| SPECIES                     | SOUTHEAST ASIA |        |                             |           |        |          |      |          |          |       |       |             |                        |                  |
|-----------------------------|----------------|--------|-----------------------------|-----------|--------|----------|------|----------|----------|-------|-------|-------------|------------------------|------------------|
|                             | Ryukyu Islands | Taiwan | China (S. of Yangtze Kiang) | Hong Kong | Hainan | Viet Nam | Laos | Cambodia | Thailand | Burma | Assam | Philippines | Sangi Islands, Taroena | Celebes, Kabaena |
| <i>ALBOPICTUS</i> SUBGROUP  |                |        |                             |           |        |          |      |          |          |       |       |             |                        |                  |
| <i>albopictus</i>           | X              | X      | X                           | X         | X      | X        | X    | X        | X        | X     | X     | X           | X                      | X                |
| <i>downsi</i>               | X              |        |                             |           |        |          |      |          |          |       |       |             |                        |                  |
| <i>novalbopictus</i>        |                |        |                             |           |        |          |      |          | X        |       |       |             |                        |                  |
| <i>patriciae</i>            |                |        |                             |           |        | X        |      | X        |          |       |       |             |                        |                  |
| <i>pseudalbopictus</i>      |                |        |                             |           |        | X        |      | X        | X        |       |       |             |                        |                  |
| <i>seatoi</i>               |                |        |                             |           |        |          |      | X        |          |       |       |             |                        |                  |
| <i>subalbopictus</i> **     |                |        |                             |           |        | ?        |      |          |          |       |       |             |                        |                  |
| <i>SCUTELLARIS</i> SUBGROUP |                |        |                             |           |        |          |      |          |          |       |       |             |                        |                  |
| <i>alcasidi</i>             |                |        |                             |           |        |          |      |          |          |       |       | X           |                        |                  |
| <i>alorensis</i>            |                |        |                             |           |        |          |      |          |          |       |       |             |                        |                  |
| <i>andrewsi</i>             |                |        |                             |           |        |          |      |          |          |       |       |             |                        |                  |
| <i>malayensis</i>           |                | X      |                             |           |        | X        |      | X        | X        |       |       |             |                        |                  |
| <i>paullusi</i>             |                |        |                             |           |        |          |      |          |          |       |       | X           | X                      | X                |
| <i>riversi</i>              | X              |        |                             |           |        |          |      |          |          |       |       |             |                        |                  |

X = Areas from which specimens were available for examination

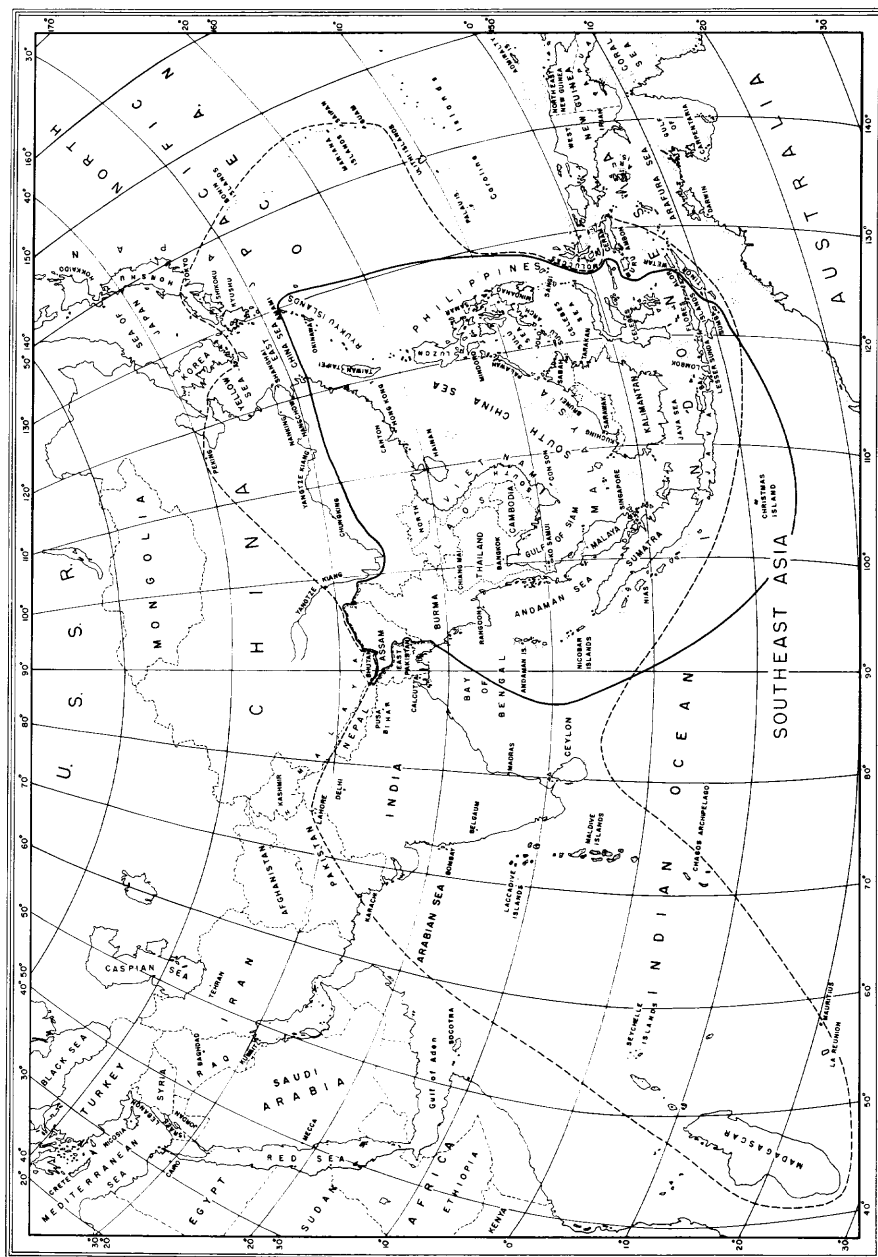


MAP I

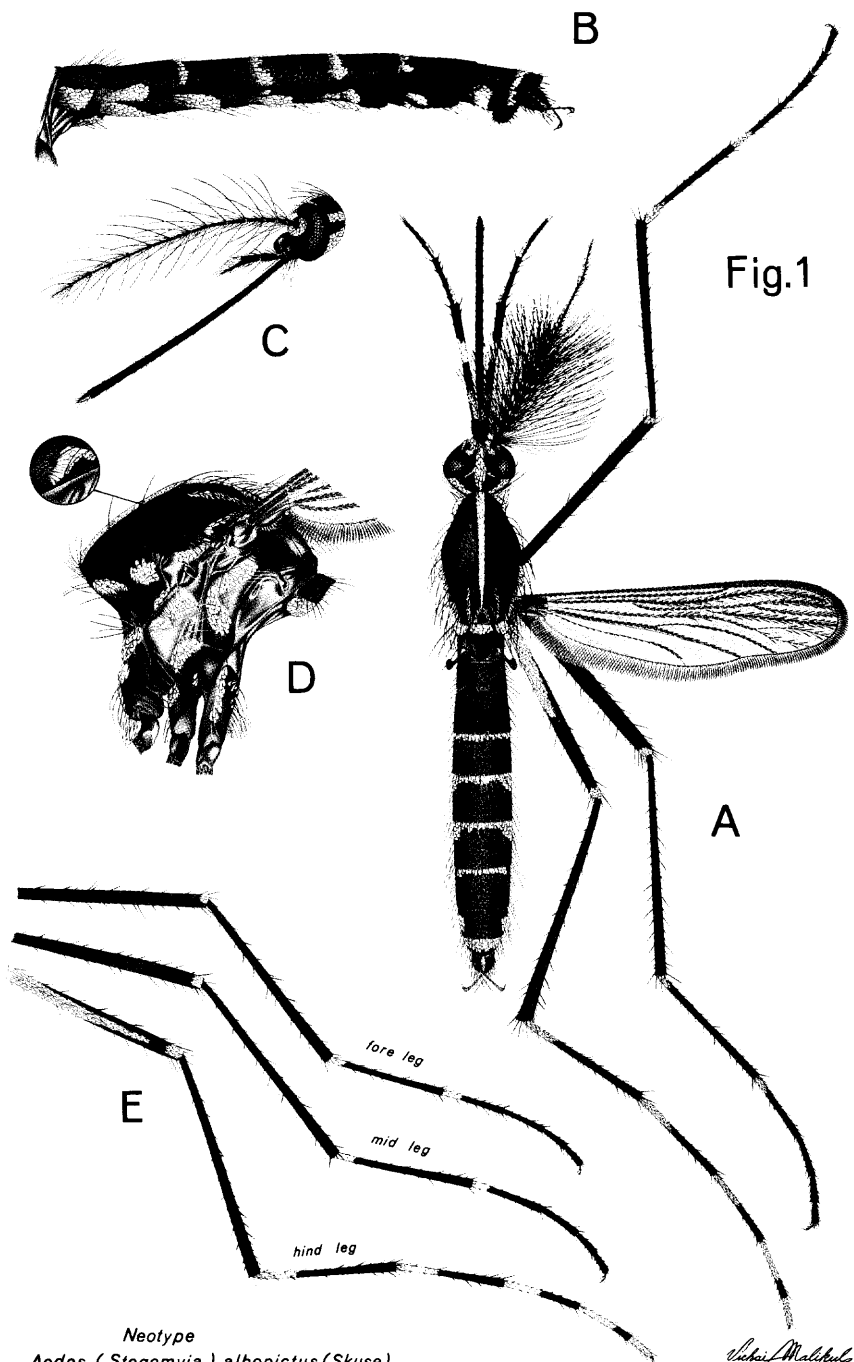


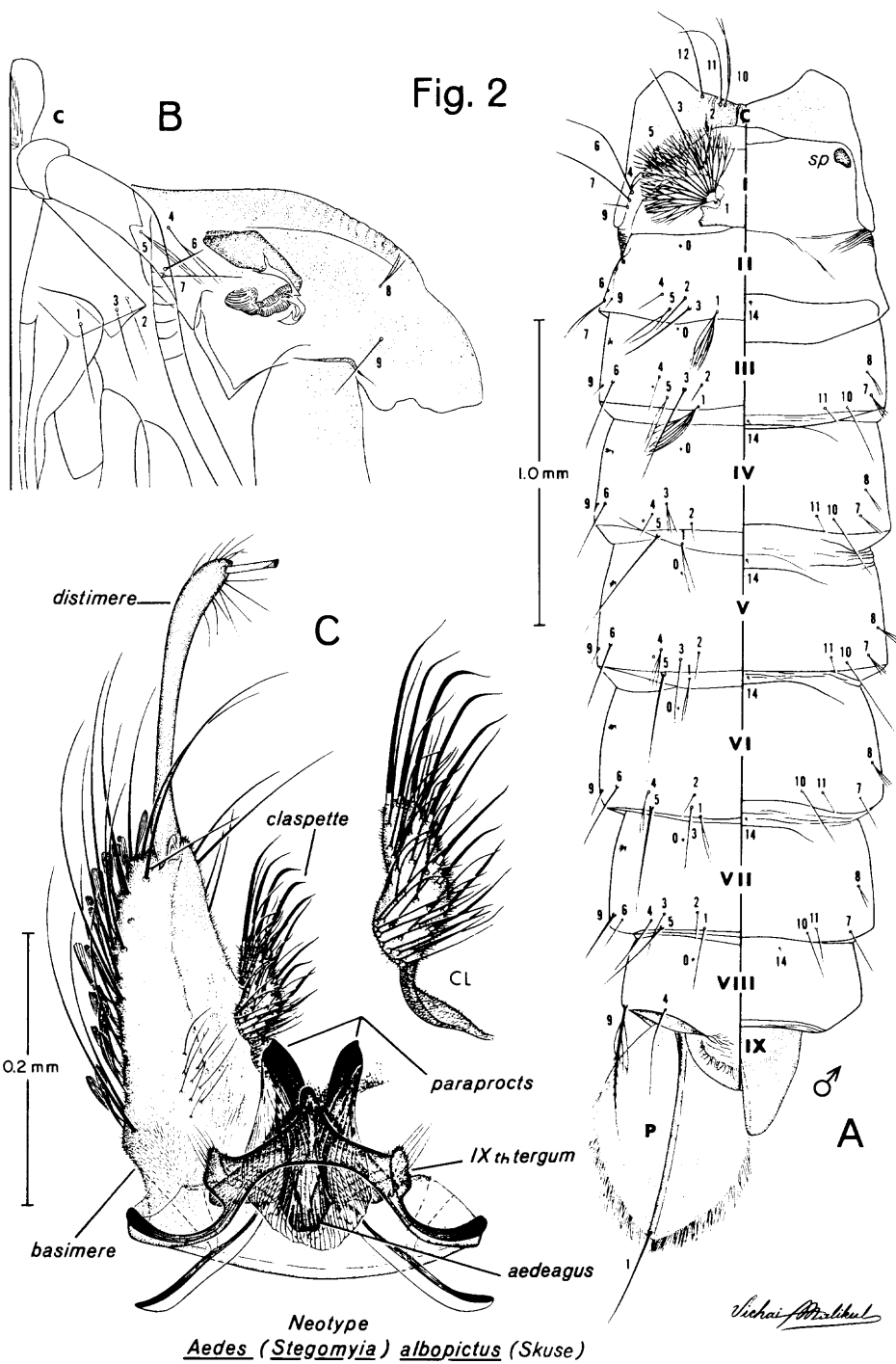
MAP I. THE SOUTHEAST ASIA AREA COVERED BY THIS REVIEW

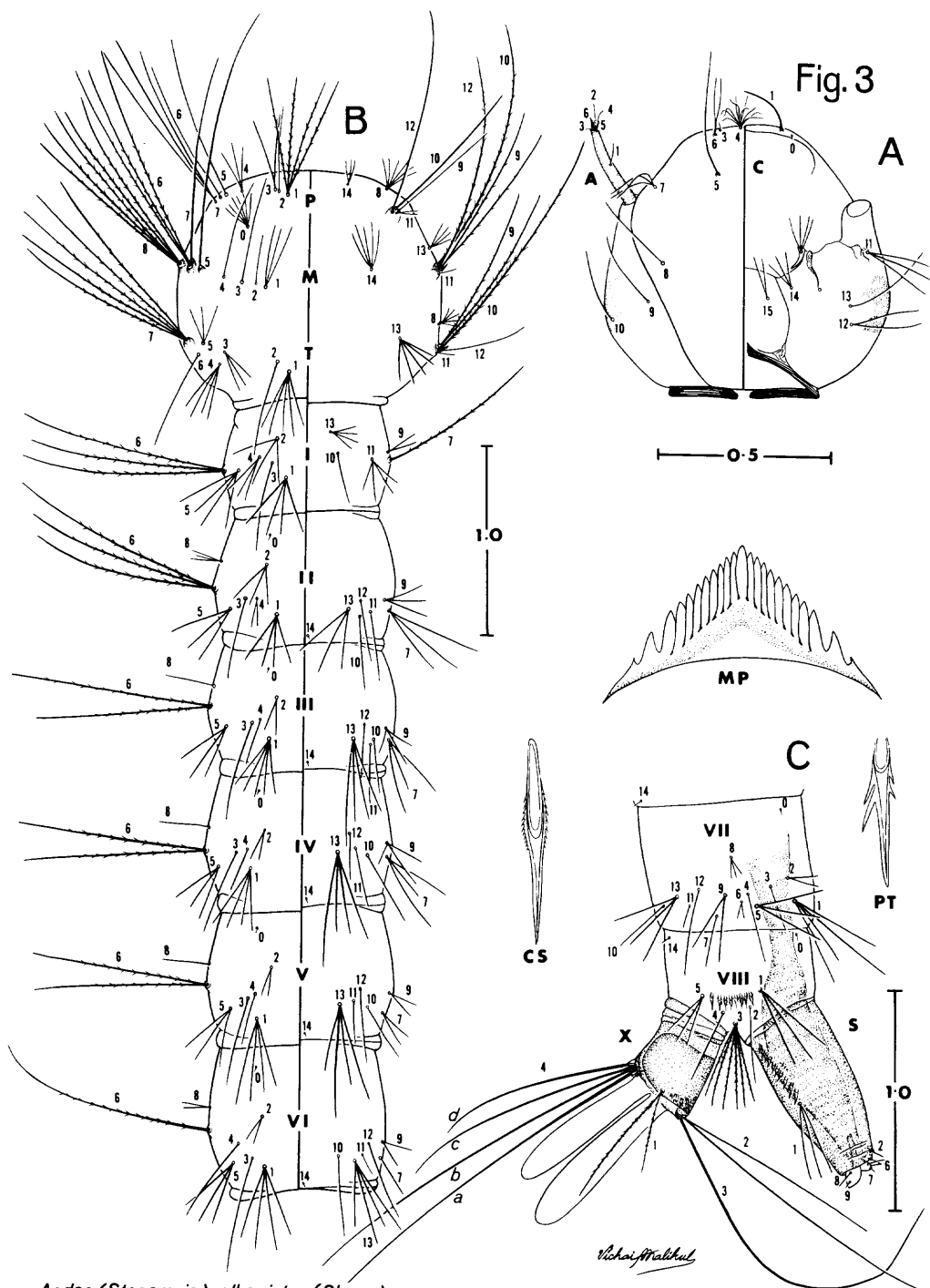
MAP II



-----Geographical Distribution of *Aedes (Stegomyia) albopictus* (Skuse),  
excluding Hawaiian Islands. Based on specimens seen by the author.







*Aedes (Stegomyia) albopictus (Skuse)*

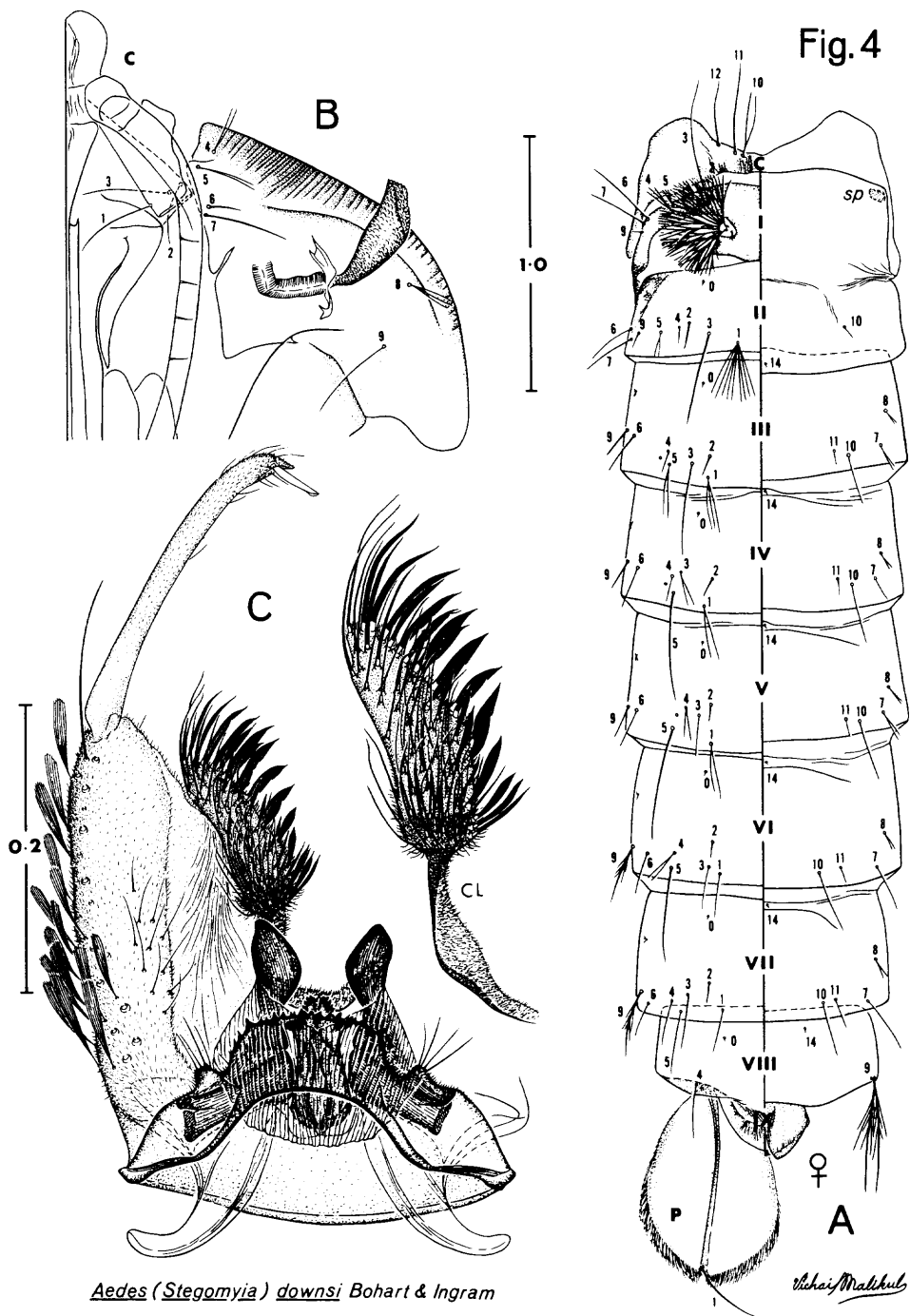
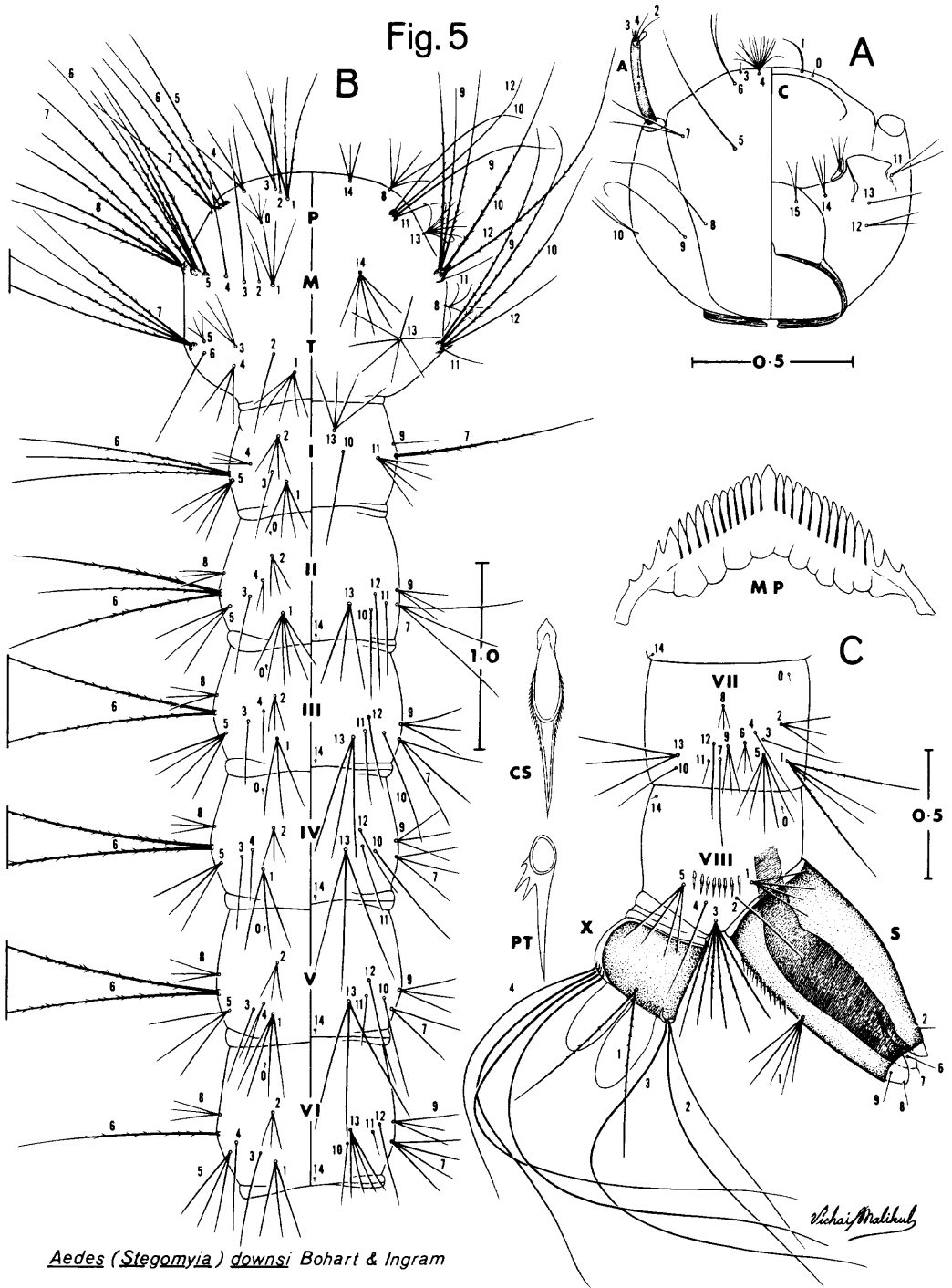




Fig. 5



*Aedes (Stegomyia) downsi* Bohart & Ingram

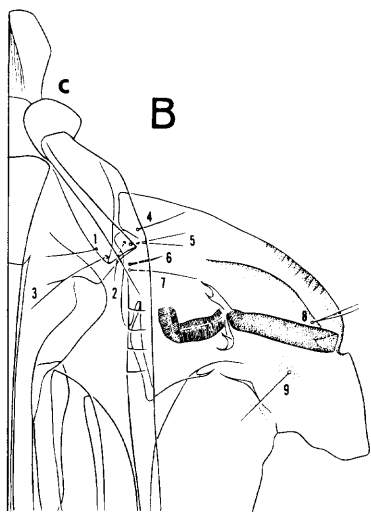
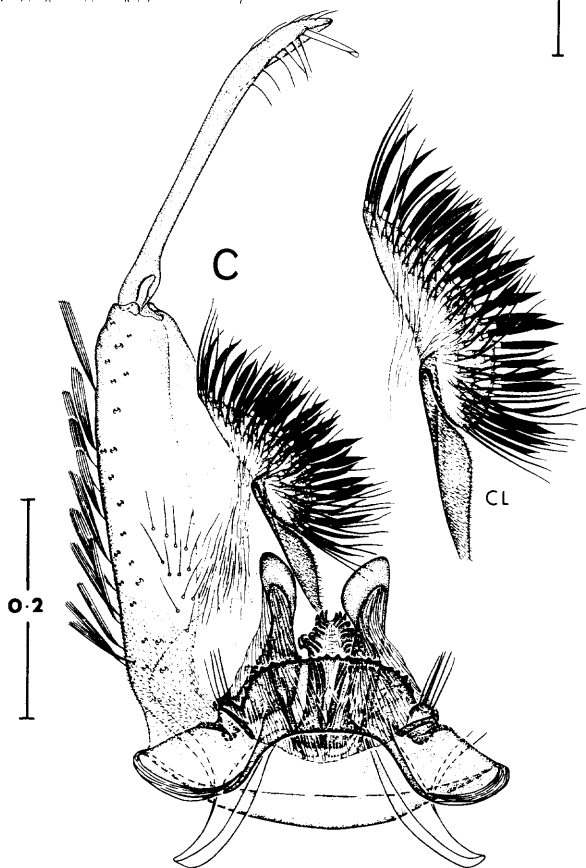


Fig.6



*Aedes (Stegomyia) flavopictus* Yamada

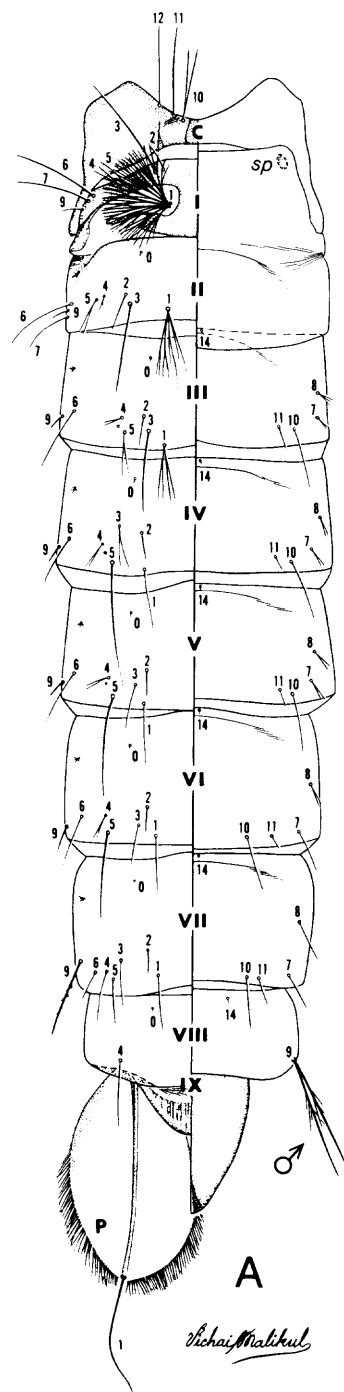
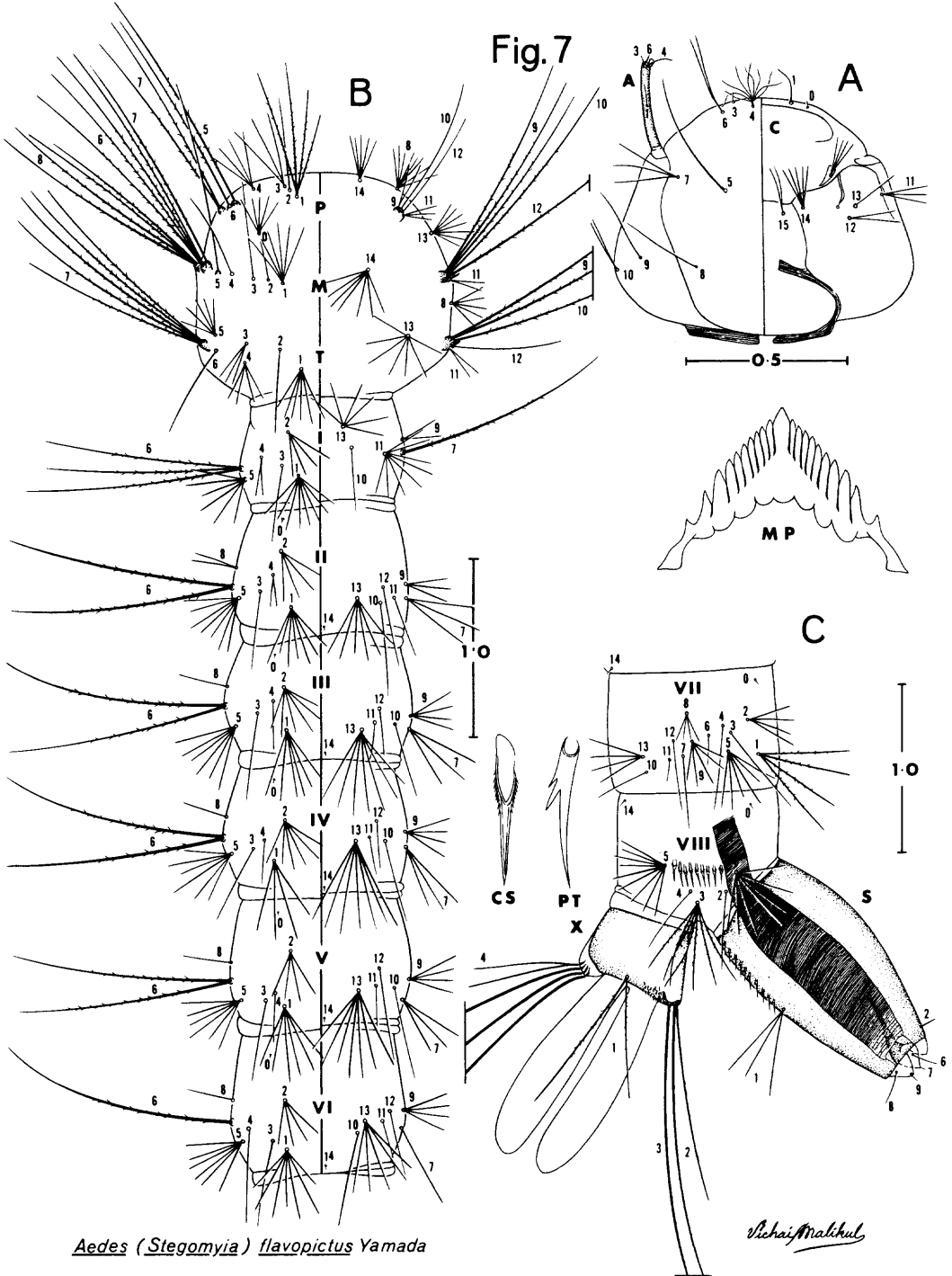


Fig. 7



*Aedes (Stegomyia) flavopictus* Yamada

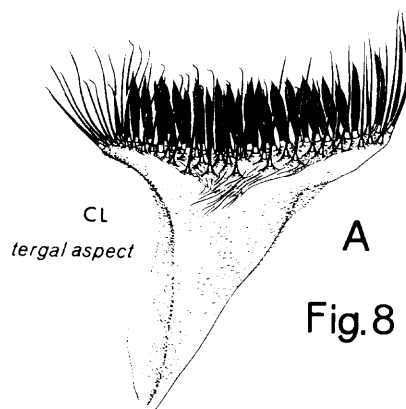
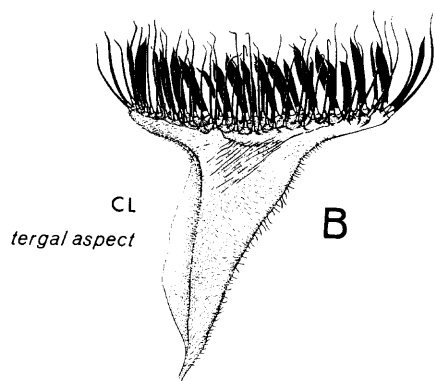


Fig.8

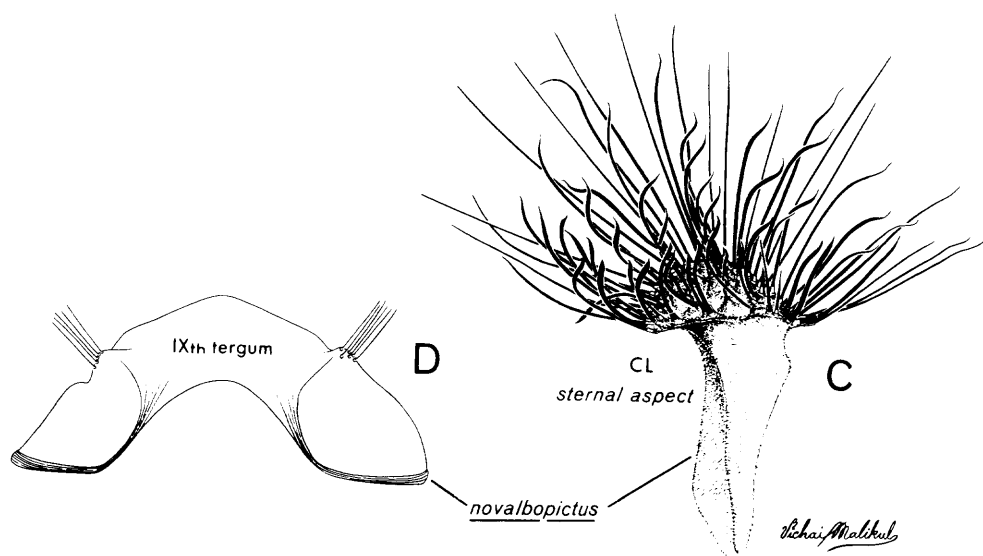
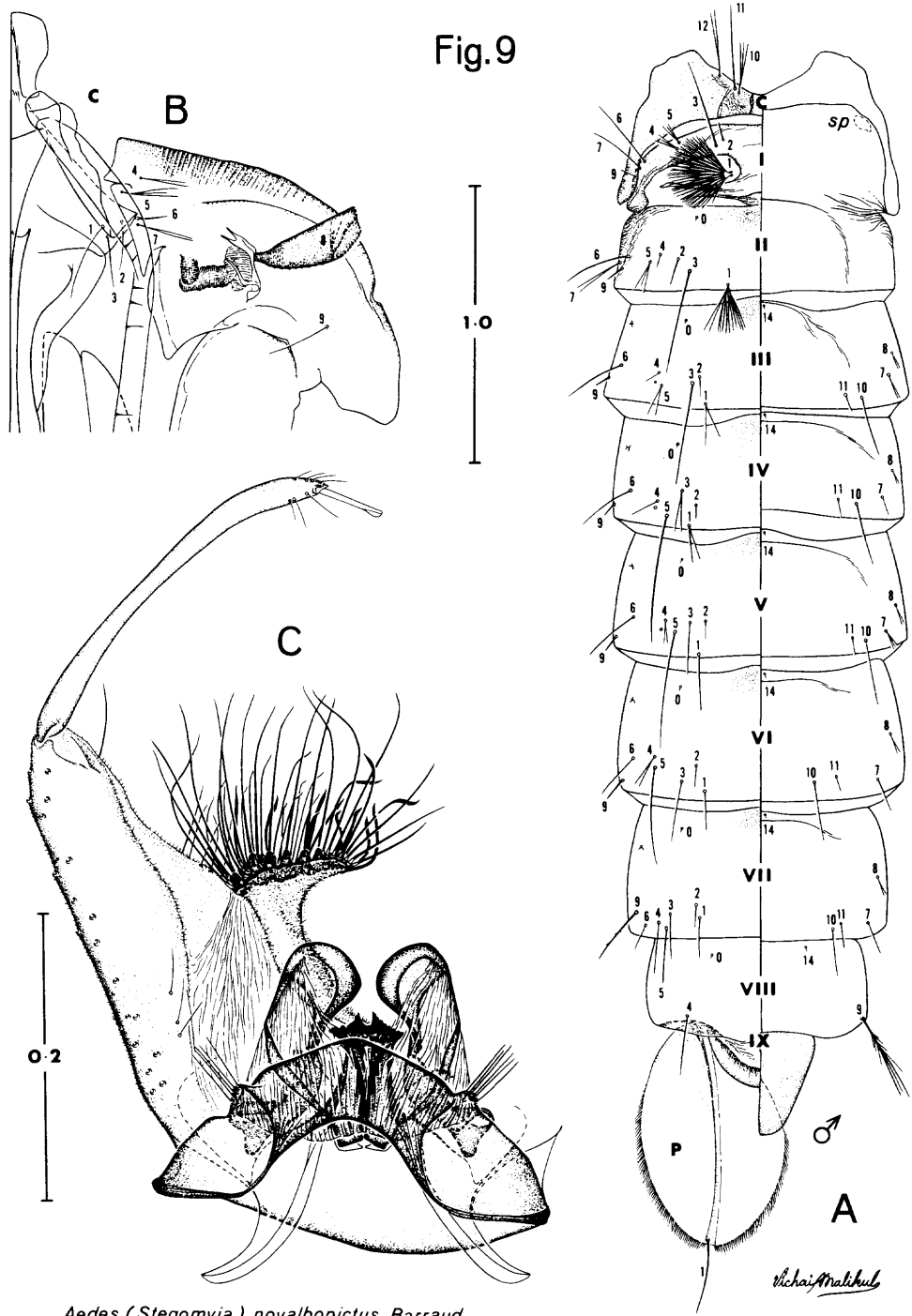
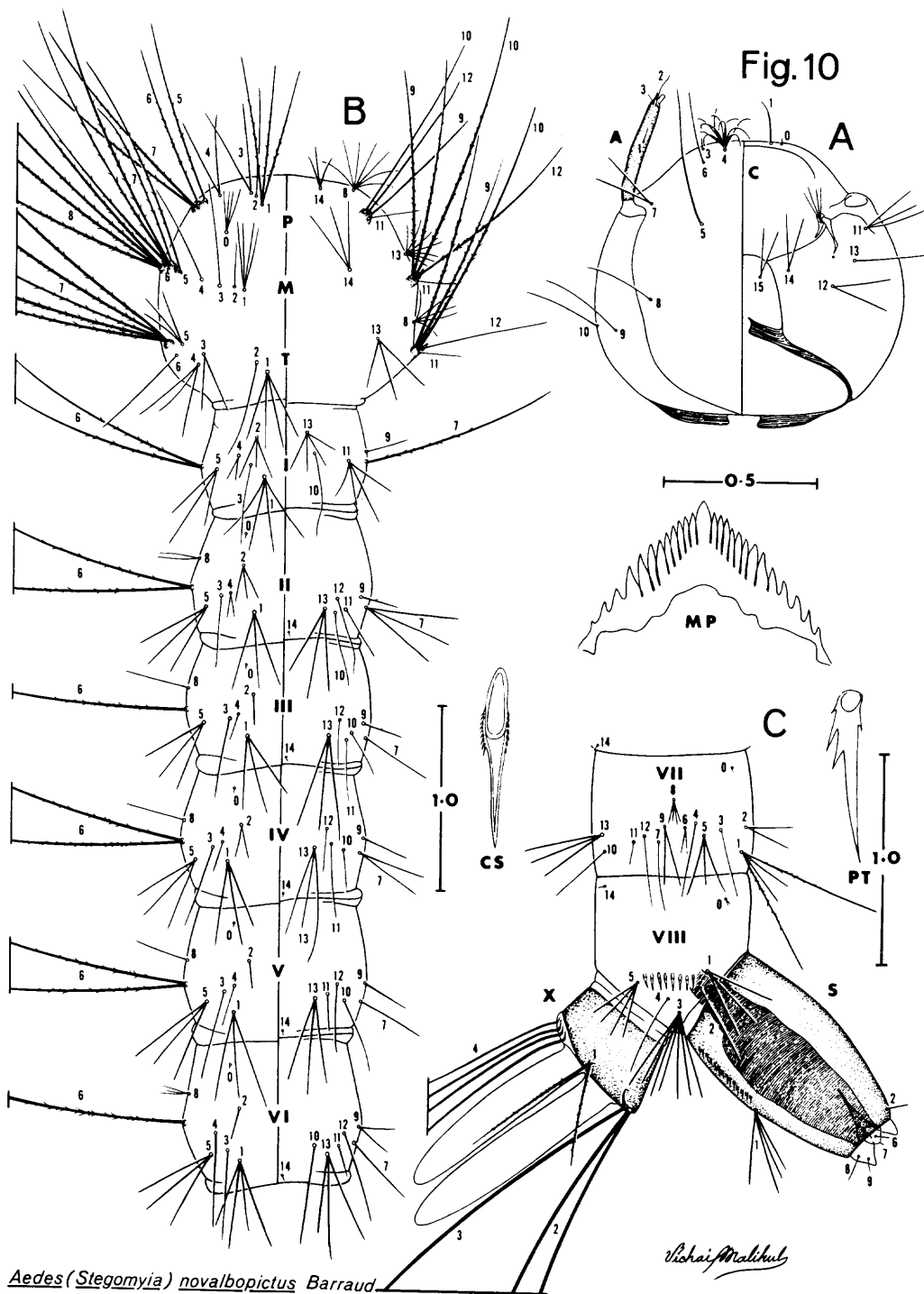
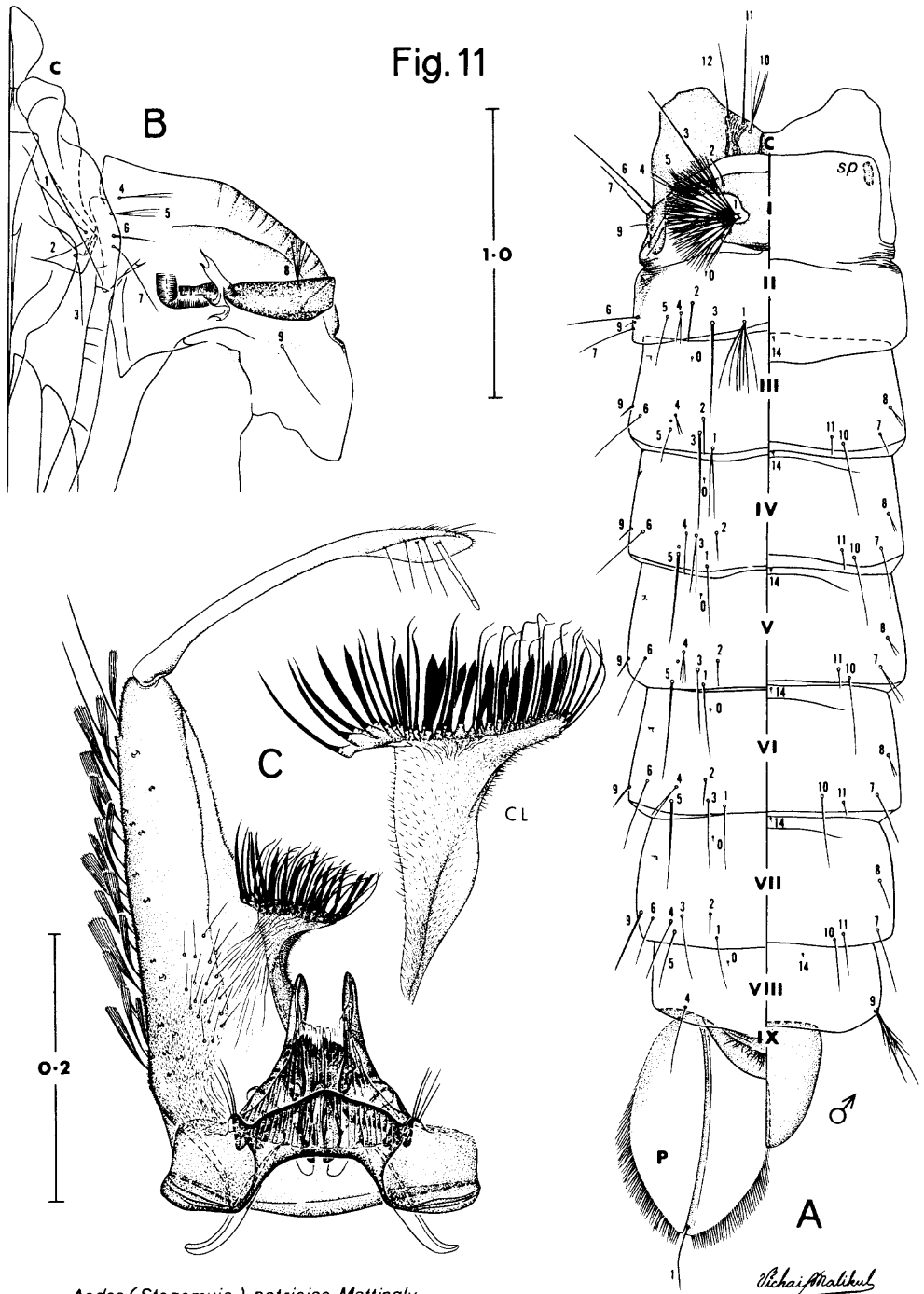


Fig.9



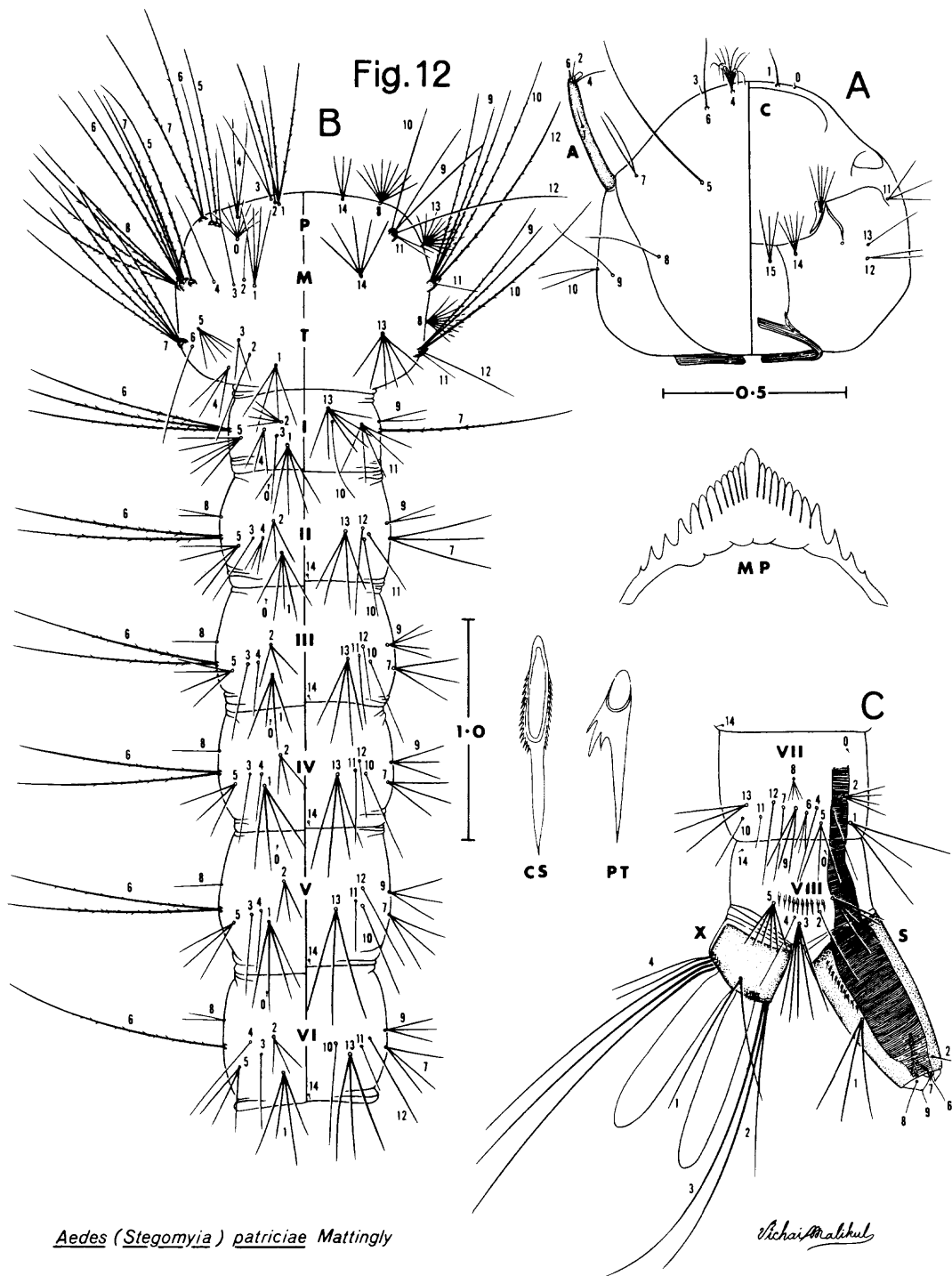
*Aedes (Stegomyia) novalbopictus* Barraud





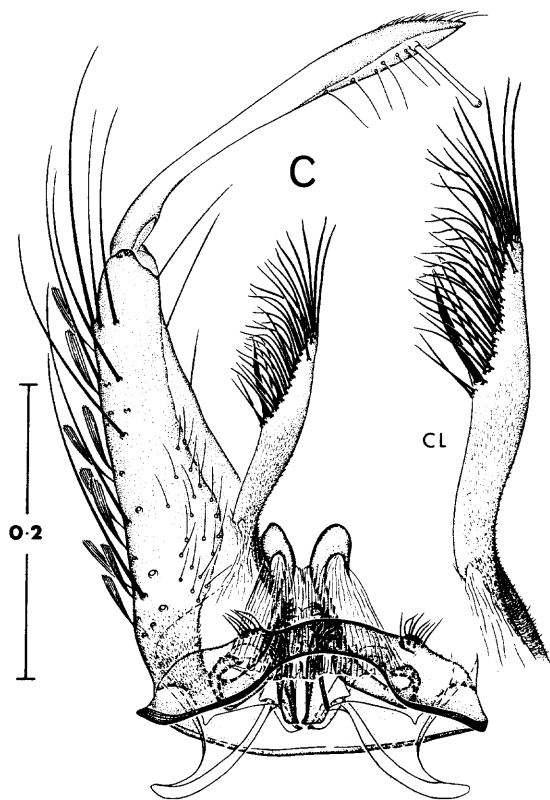
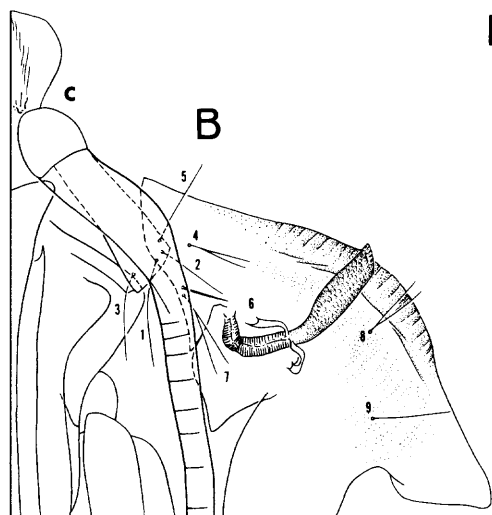
*Aedes (Stegomyia) patriciae* Mattingly

Fig.12



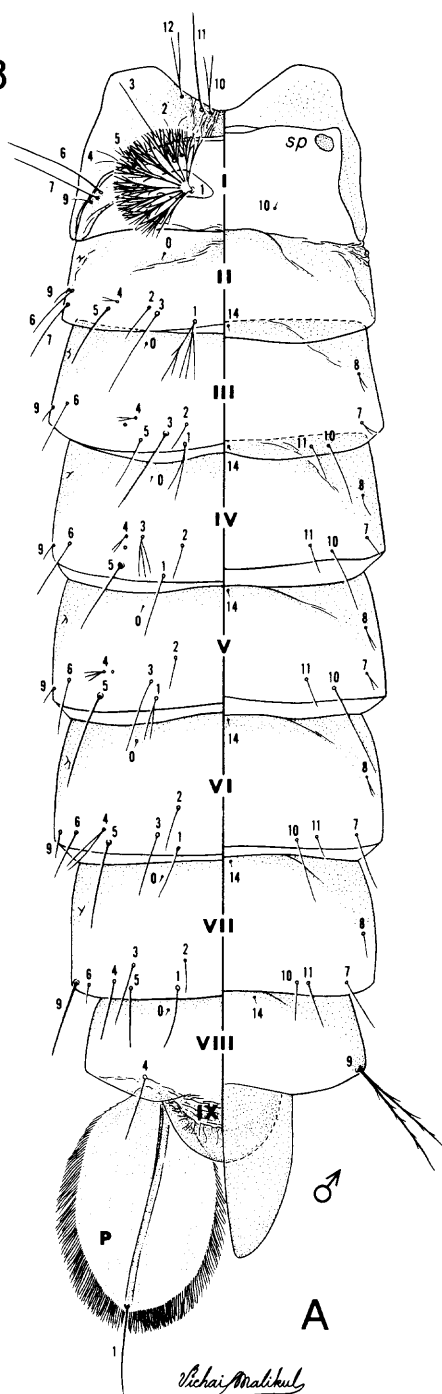
*Aedes (Stegomyia) patriciae* Mattingly

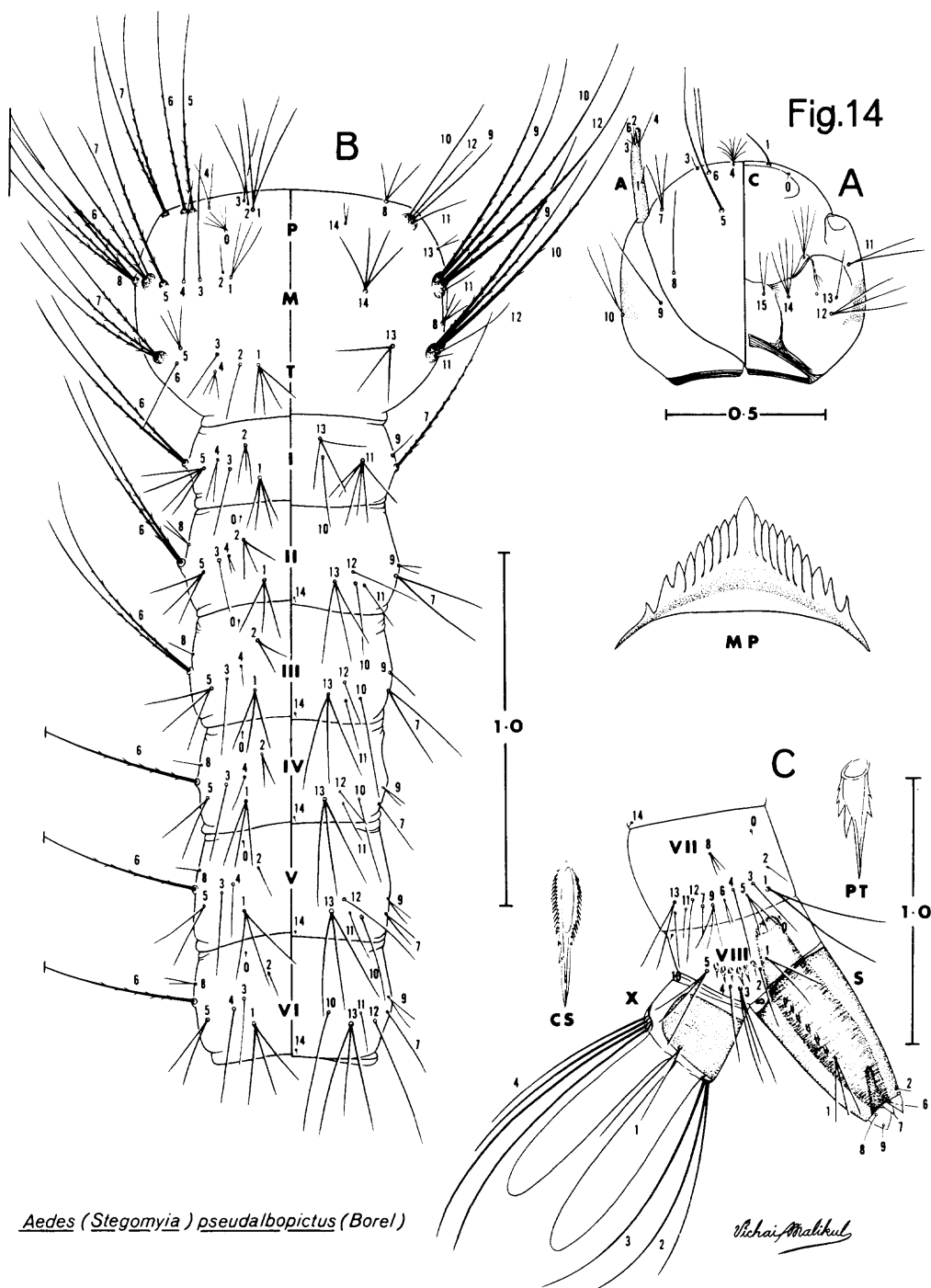


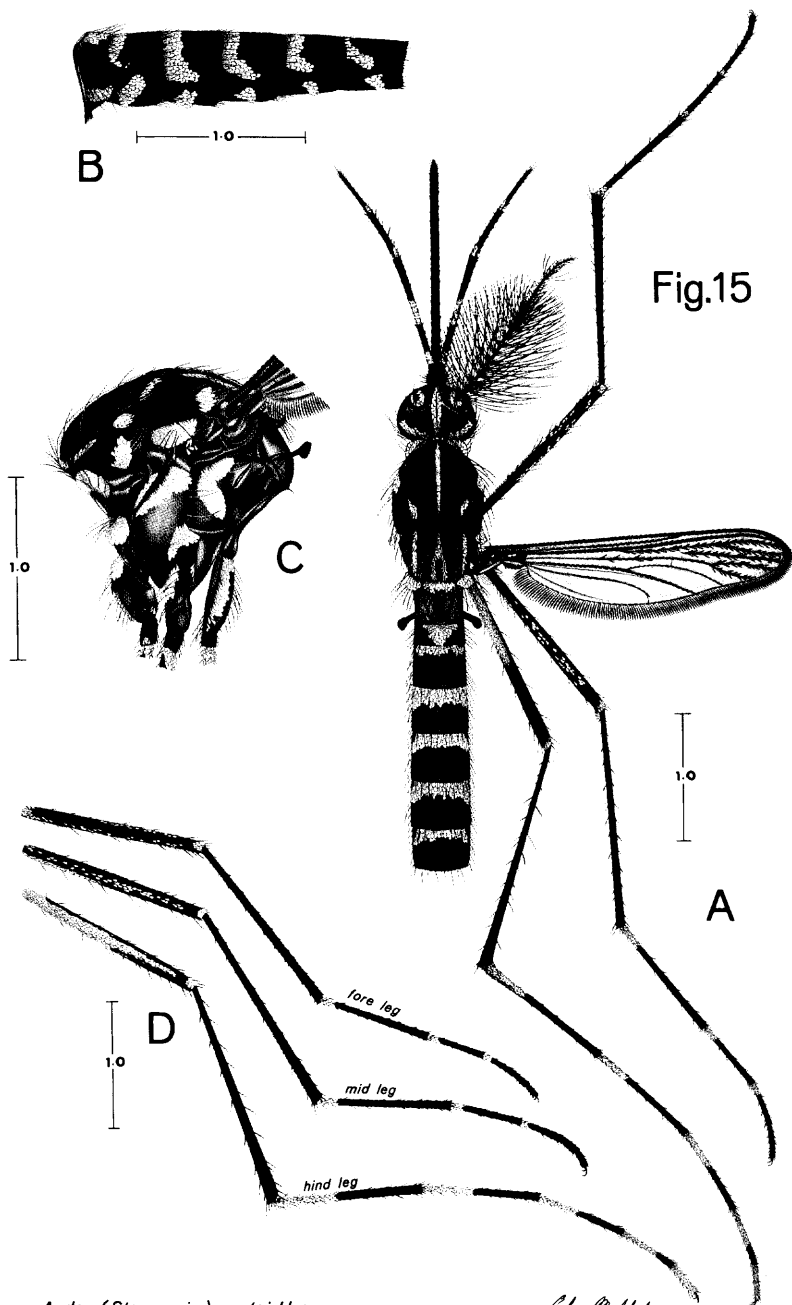


*Aedes (Stegomyia) pseudalbopictus (Borel)*

Fig.13

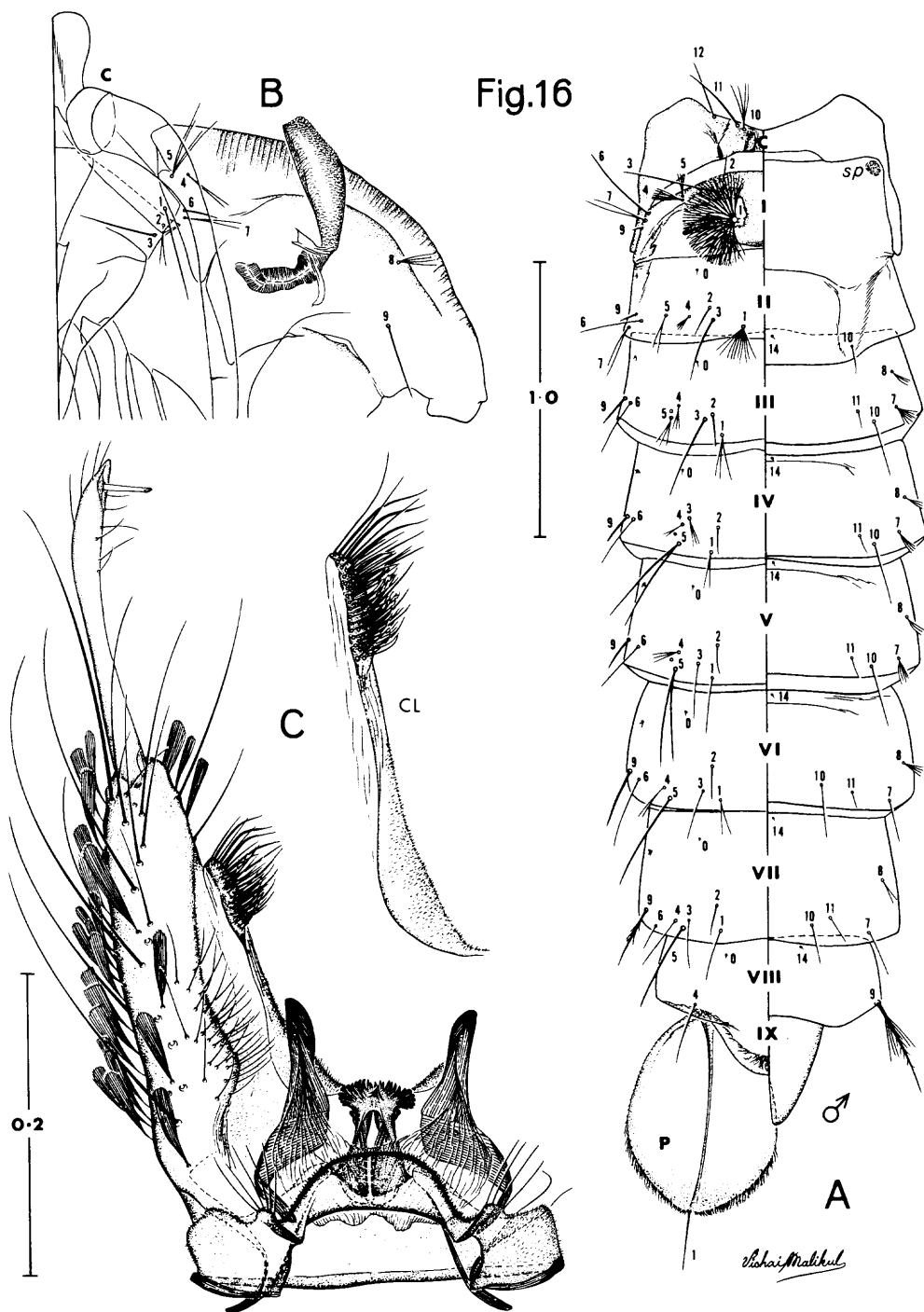




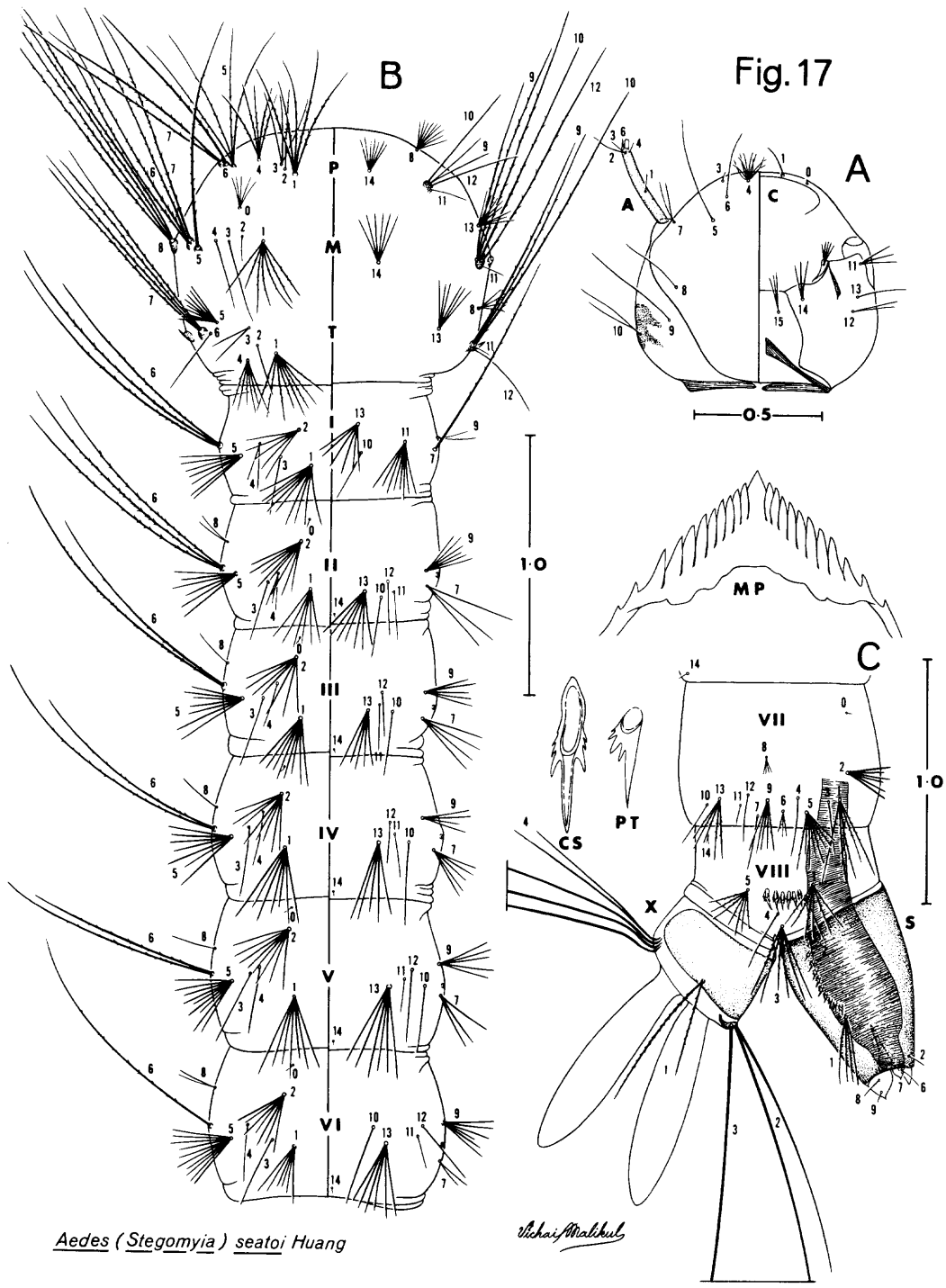


*Aedes (Stegomyia) seatoi* Huang

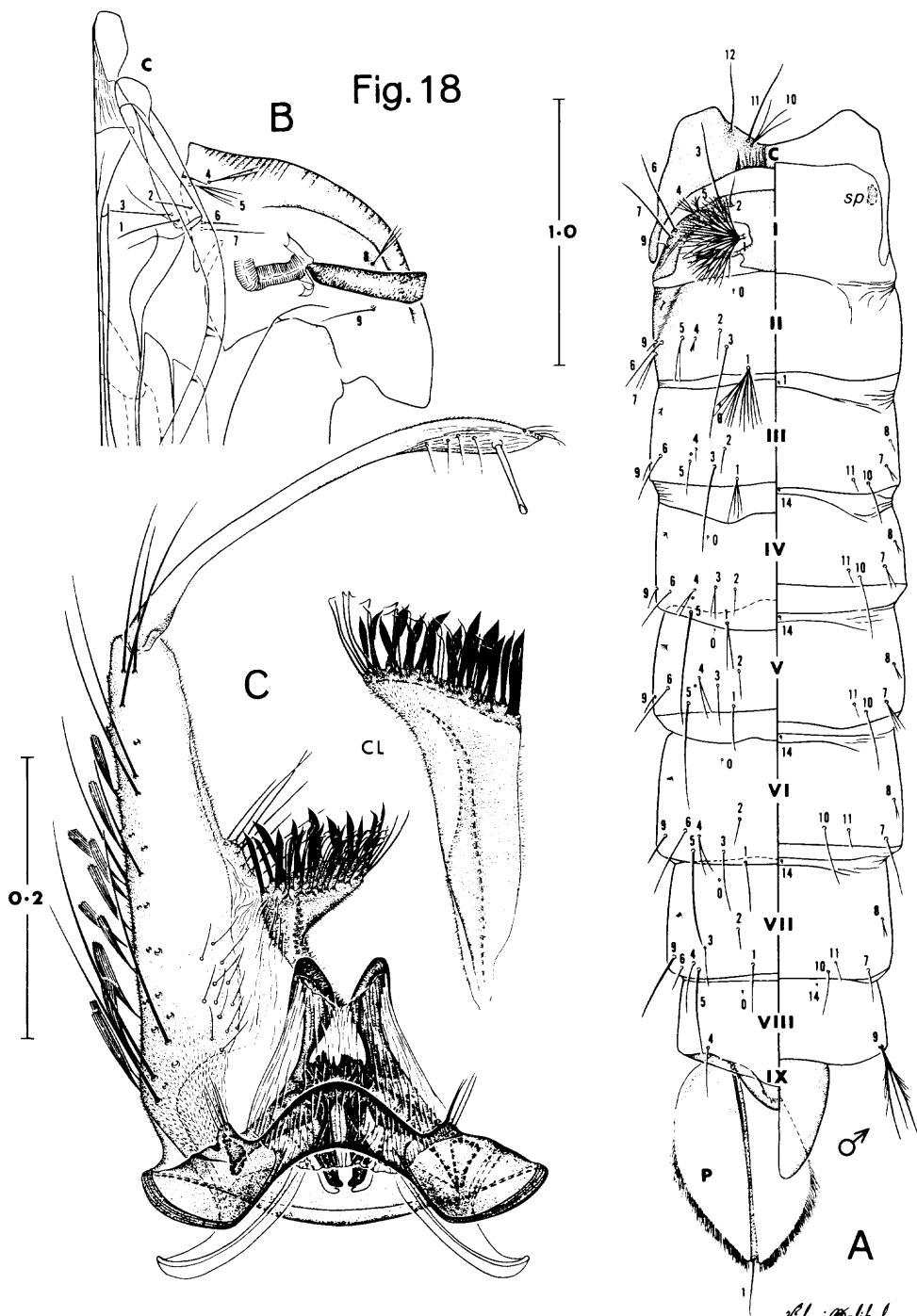
*Lichen Mahabul*



*Aedes (Stegomyia) seatoi* Huang



*Aedes (Stegomyia) seatoi* Huang



*Aedes (Stegomyia) subalbopictus* Barraud

*Shahj Malikul*



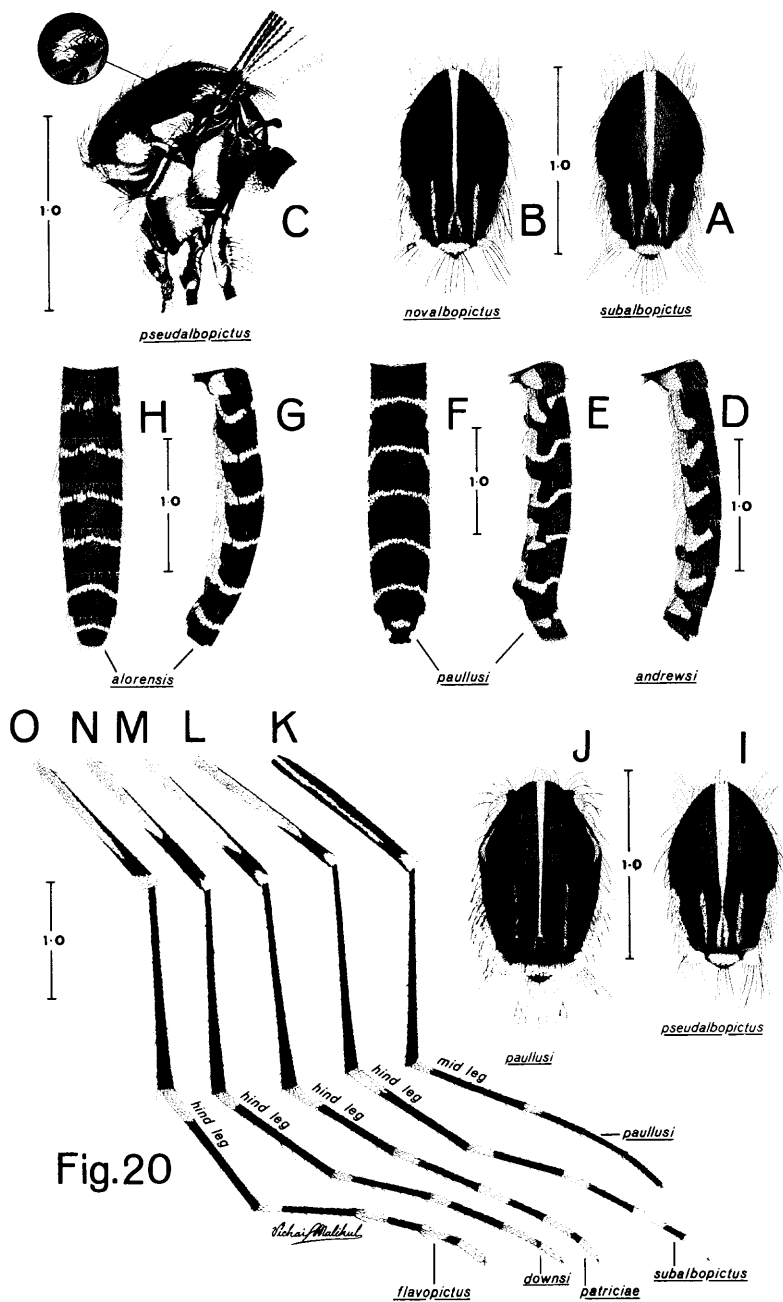
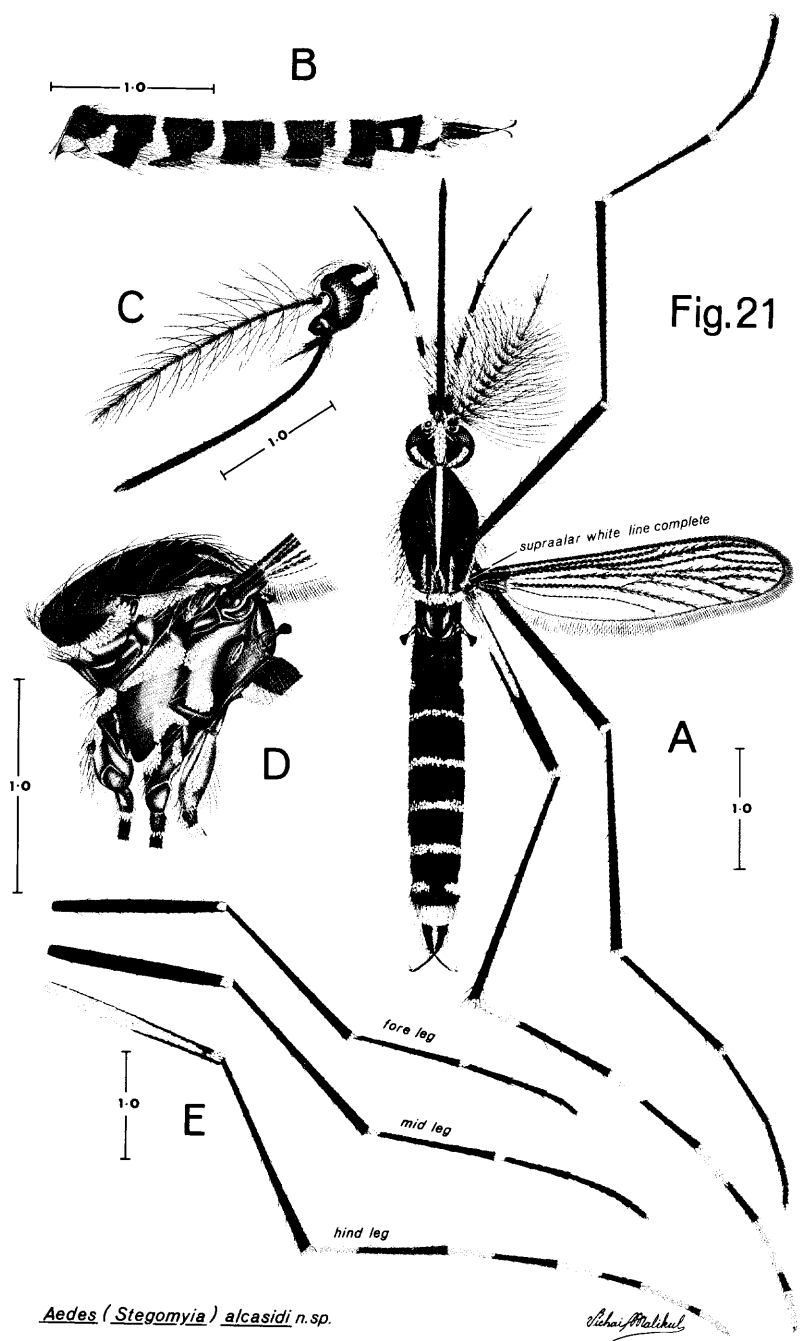
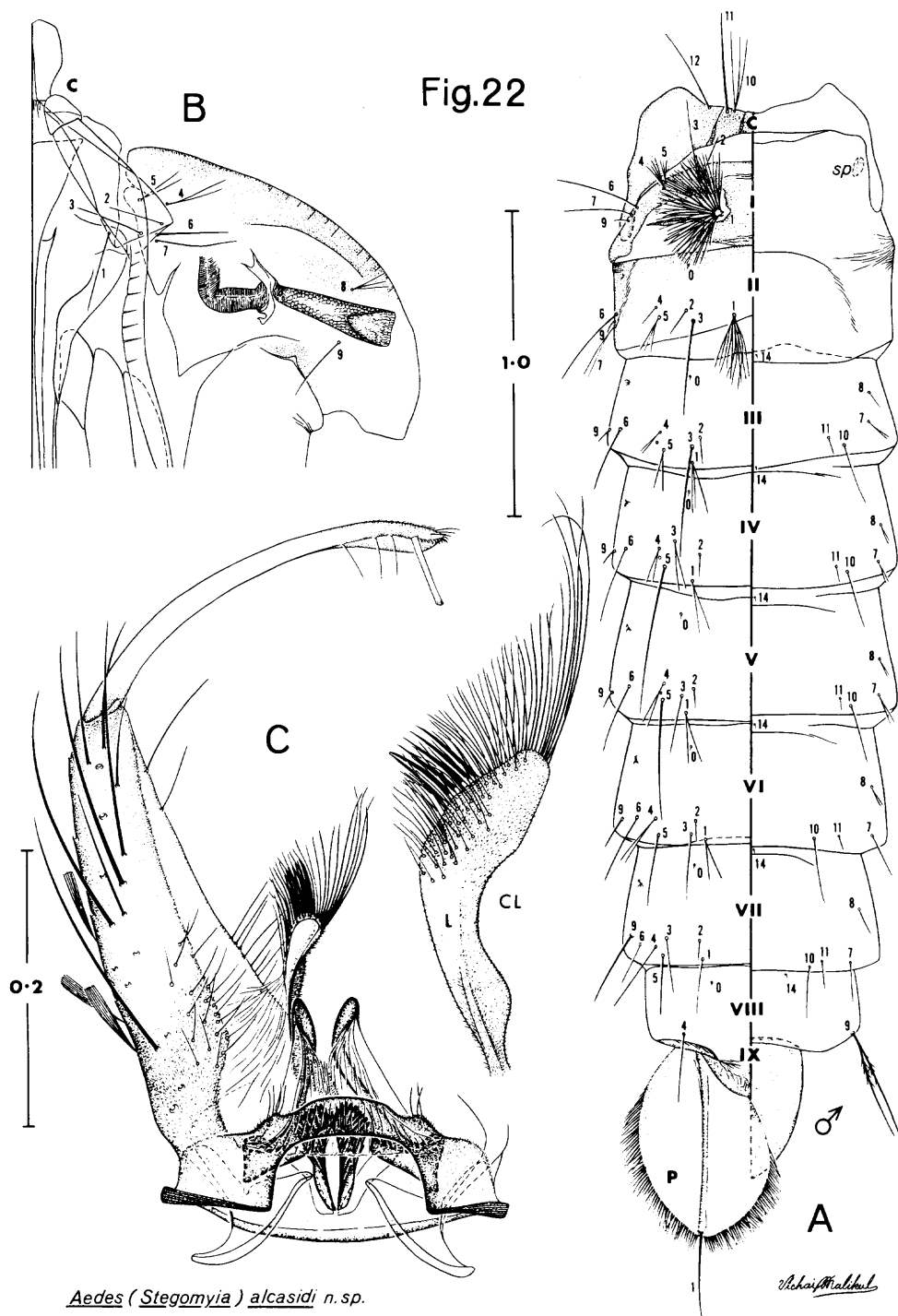


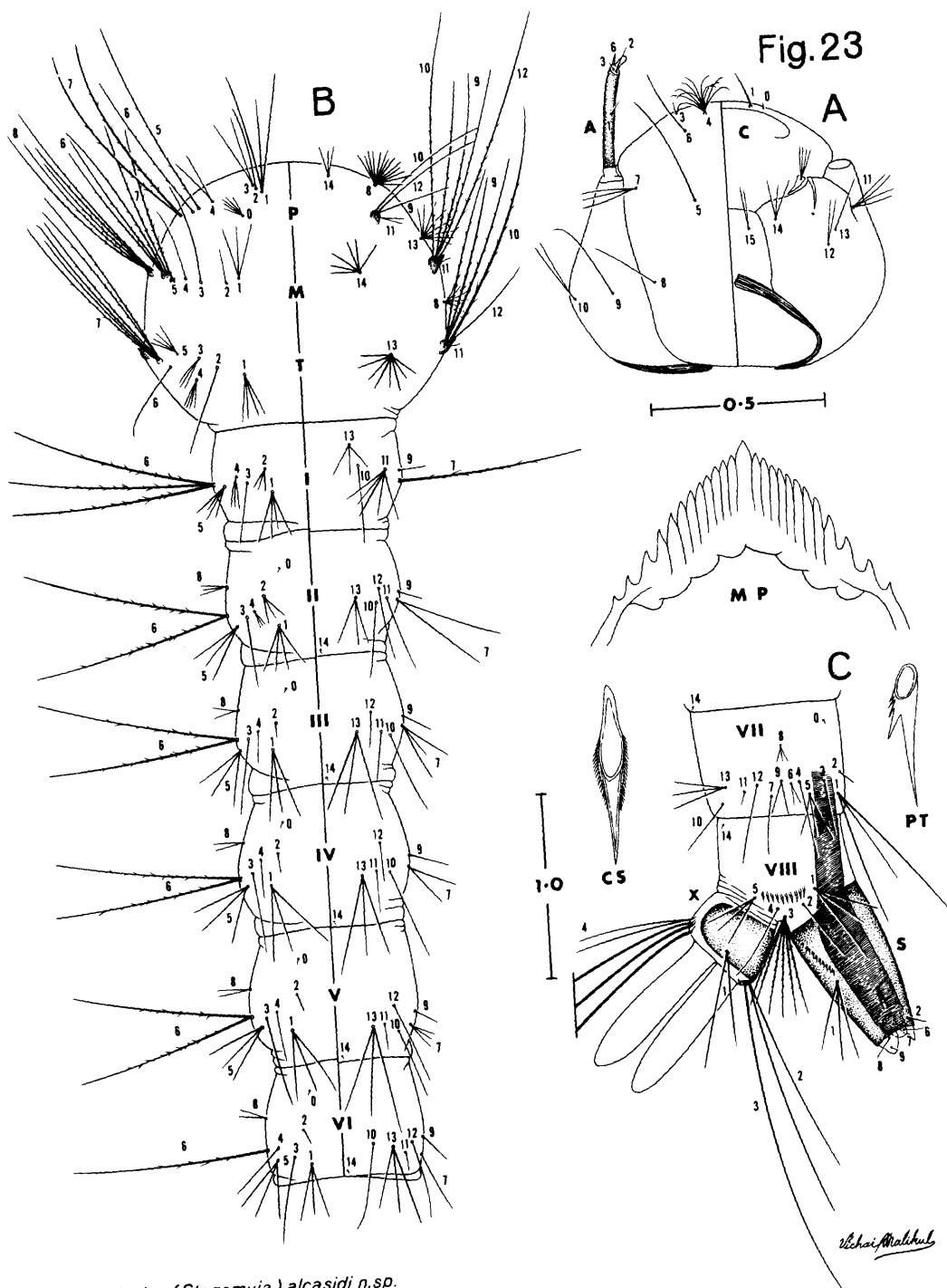
Fig.20





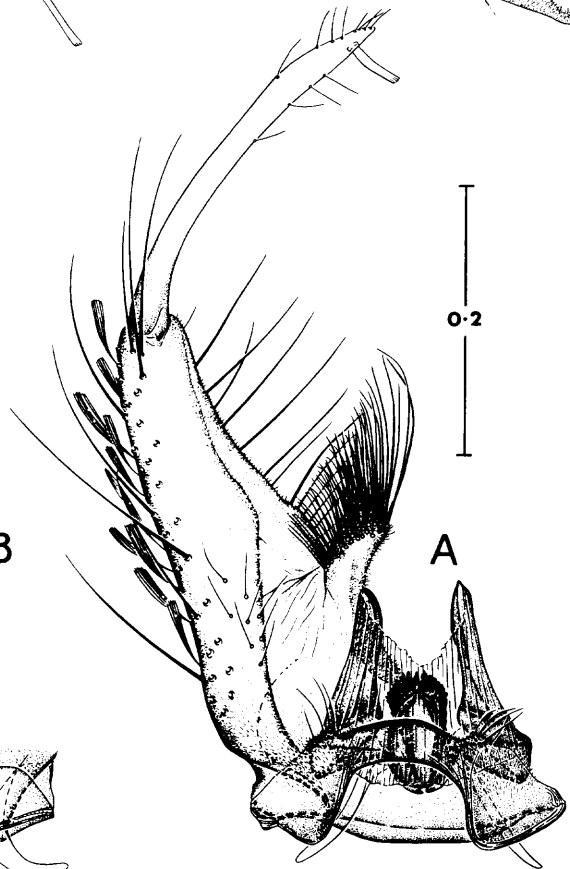
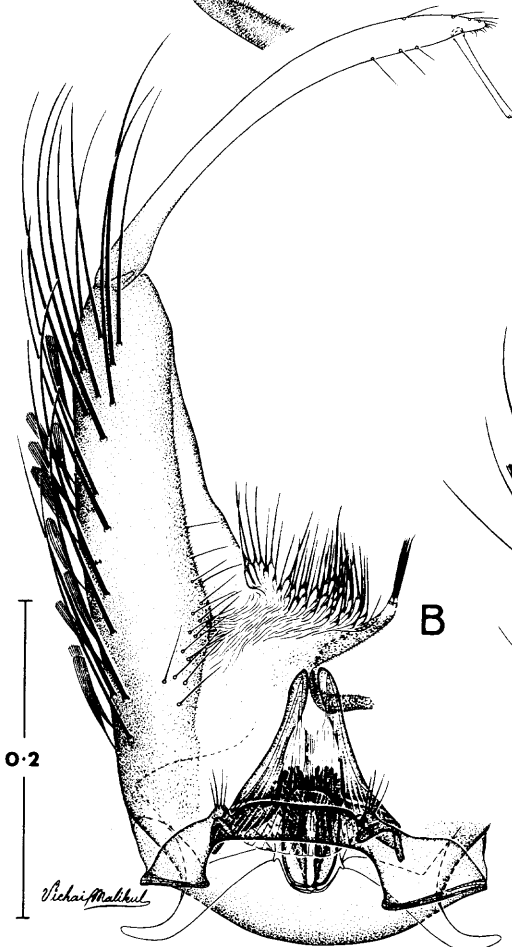
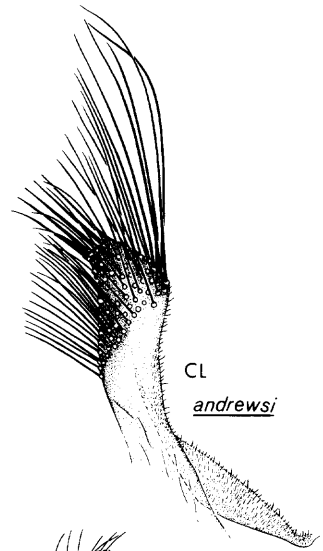
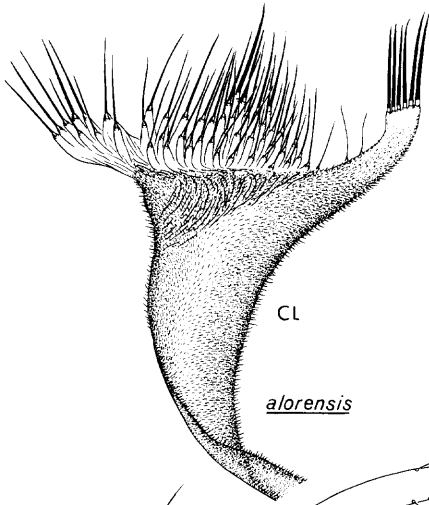


*Aedes (Stegomyia) alcasidi n.sp.*



*Aedes (Stegomyia) alcasidi* n.sp.

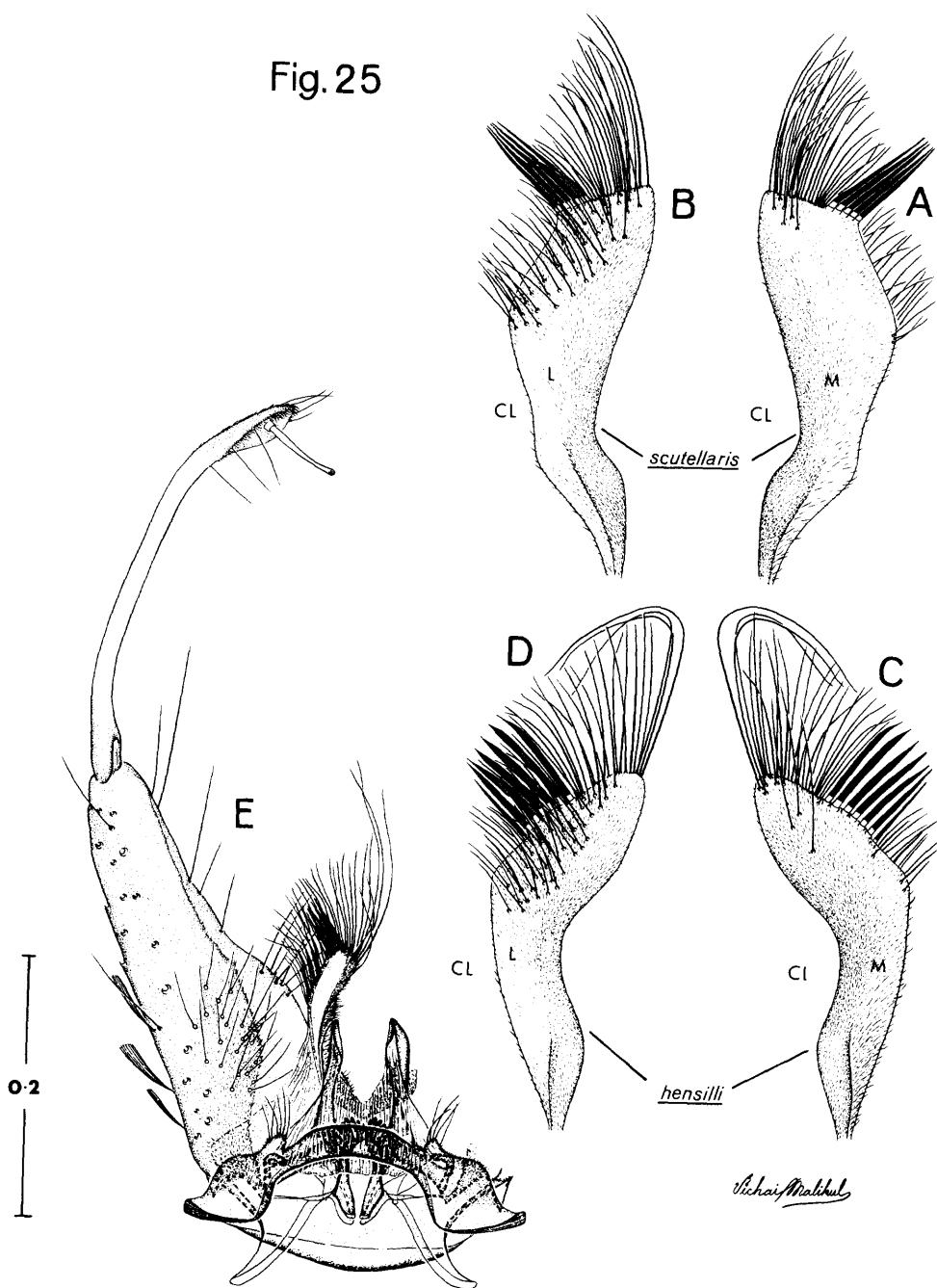
Fig. 24



*Aedes (Stegomyia) alorensis* Bonne-Wepster & Brug

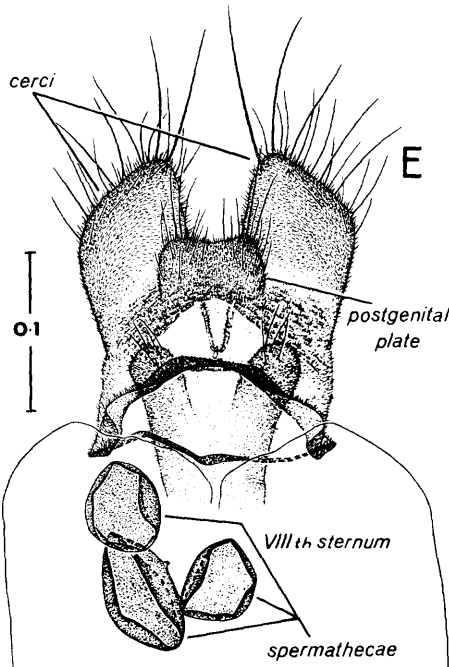
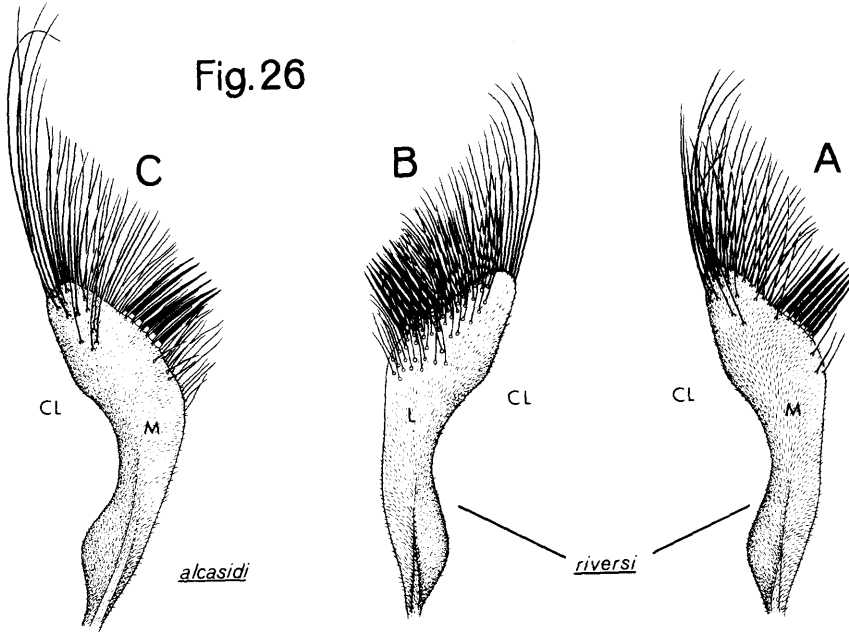
*Aedes (Stegomyia) andrewsi* Edwards

Fig. 25



*Aedes (Stegomyia) hensilli* Farner

Fig. 26



*Aedes (Stegomyia) malayensis* Colless

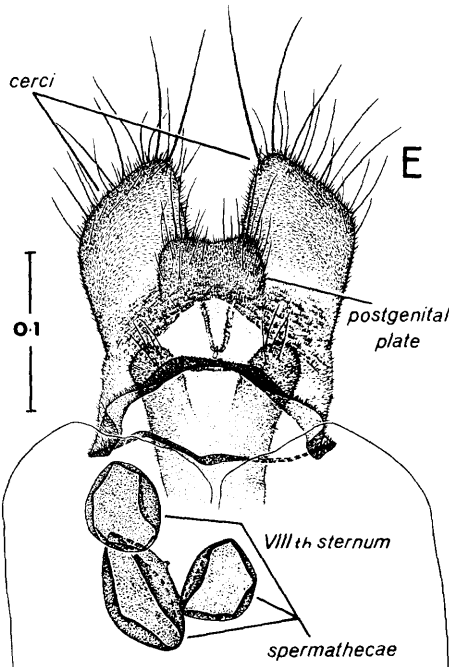
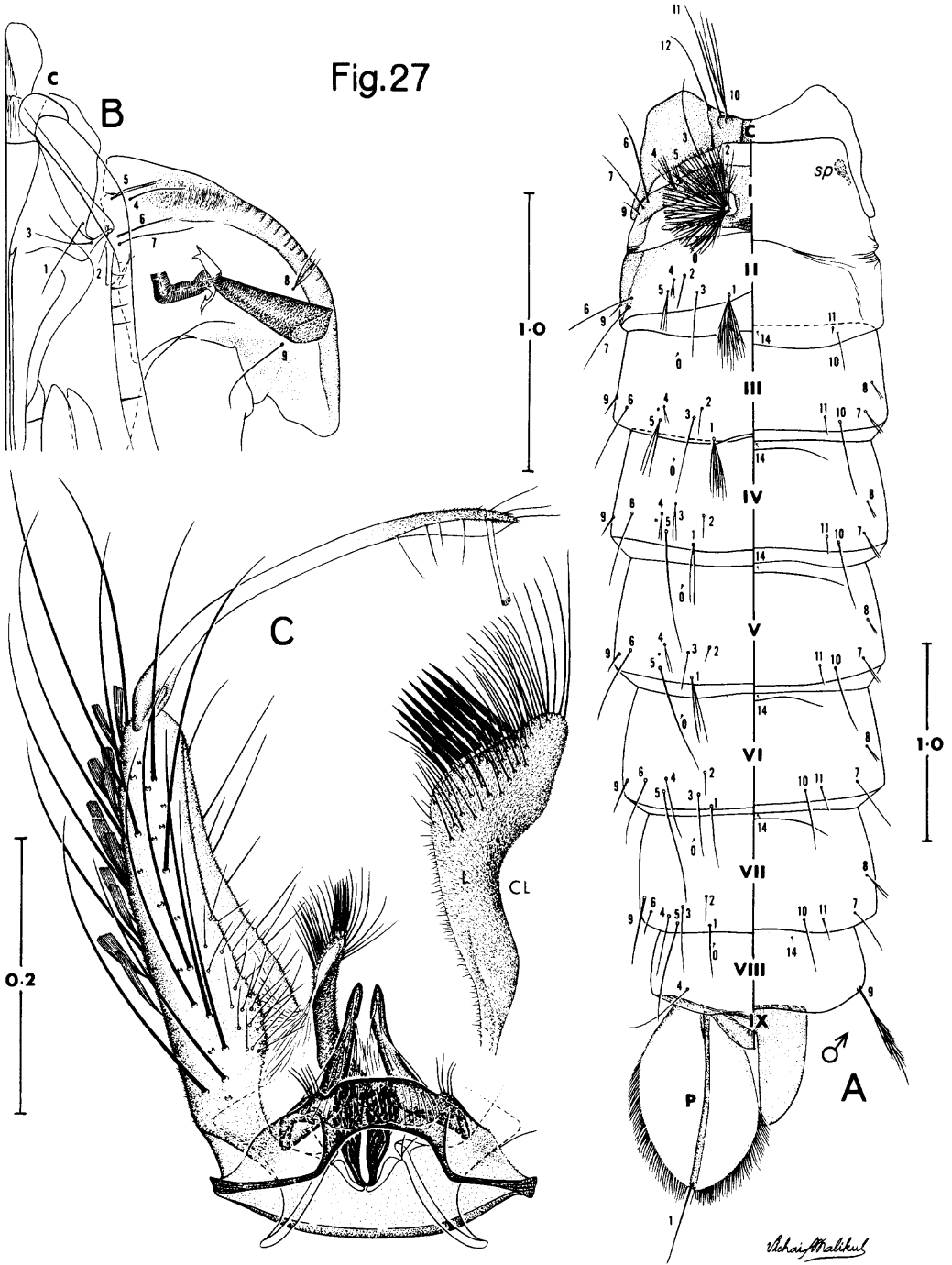
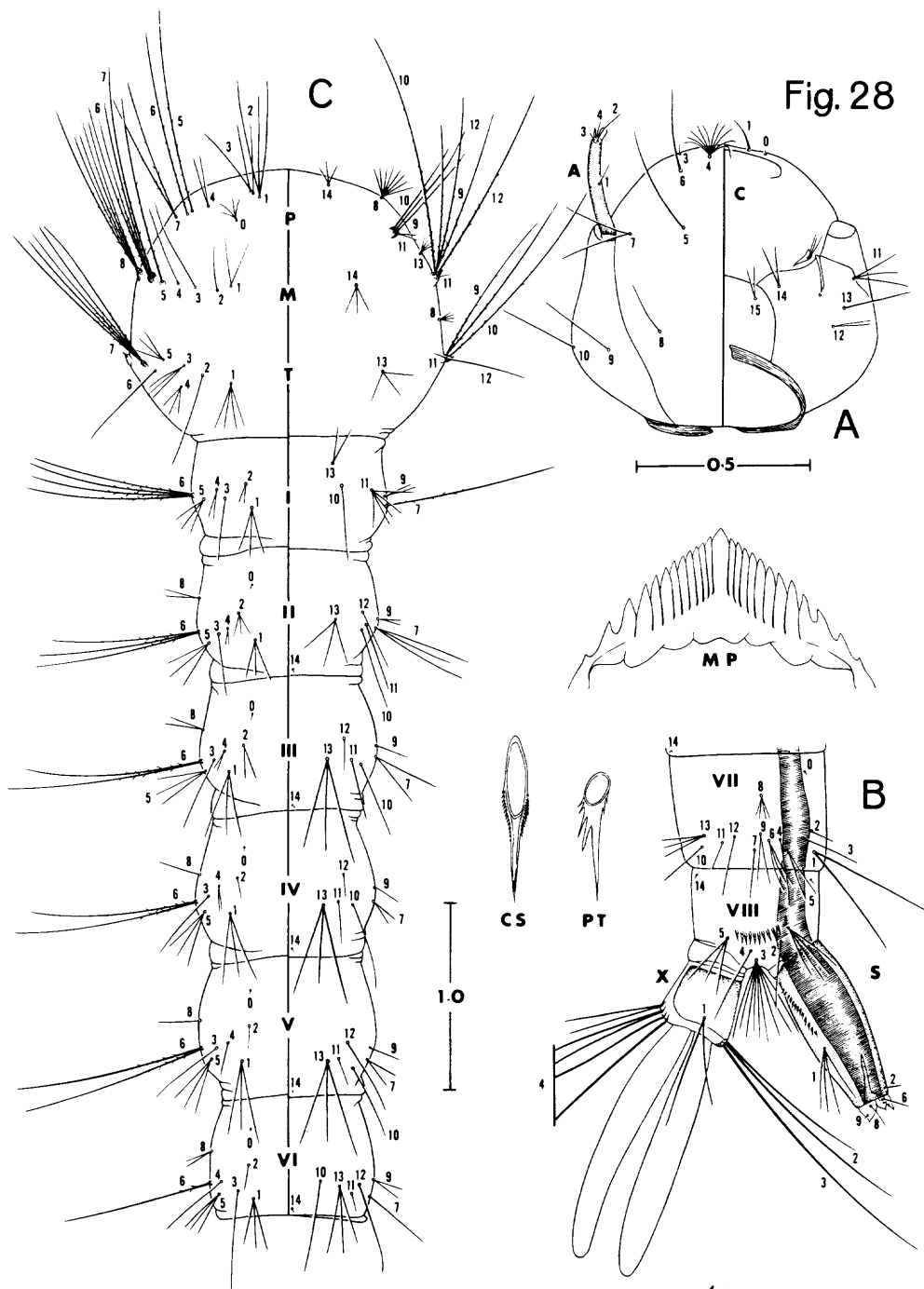


Fig.27



*Aedes (Stegomyia) malayensis* Colless

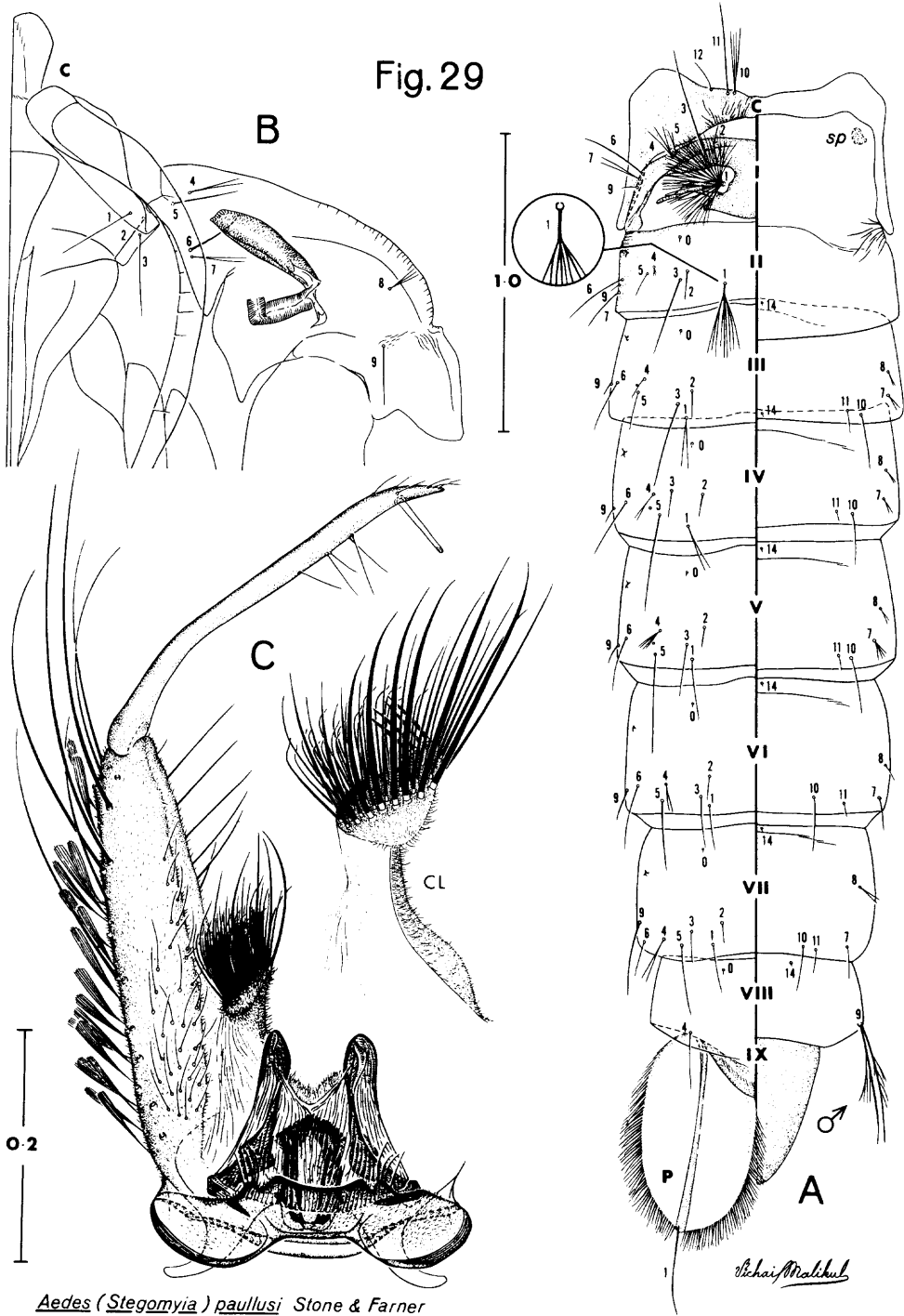


*Aedes (Stegomyia) malayensis* Colless

Vichai Malikhul



Fig. 29



*Aedes (Stegomyia) paullusi* Stone & Farner

Vishai Malikul



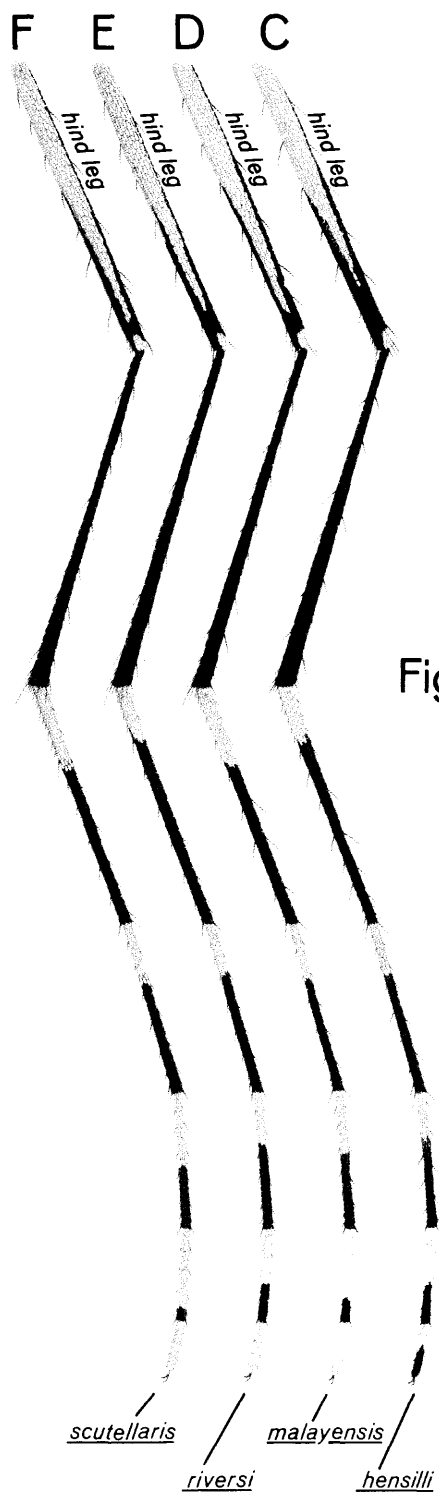
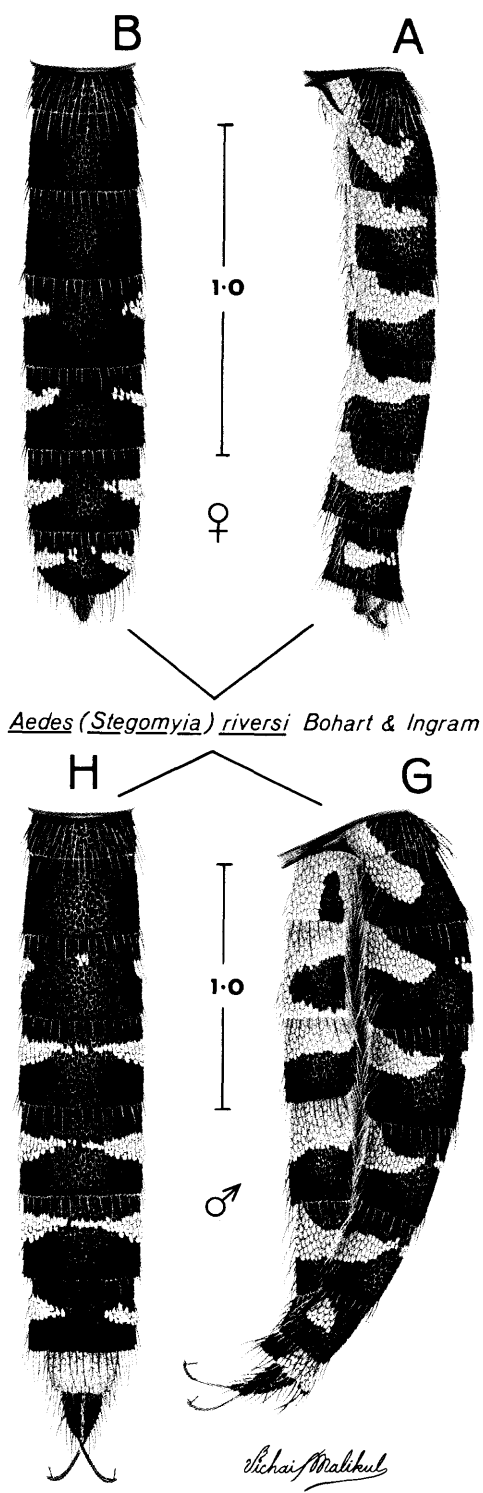
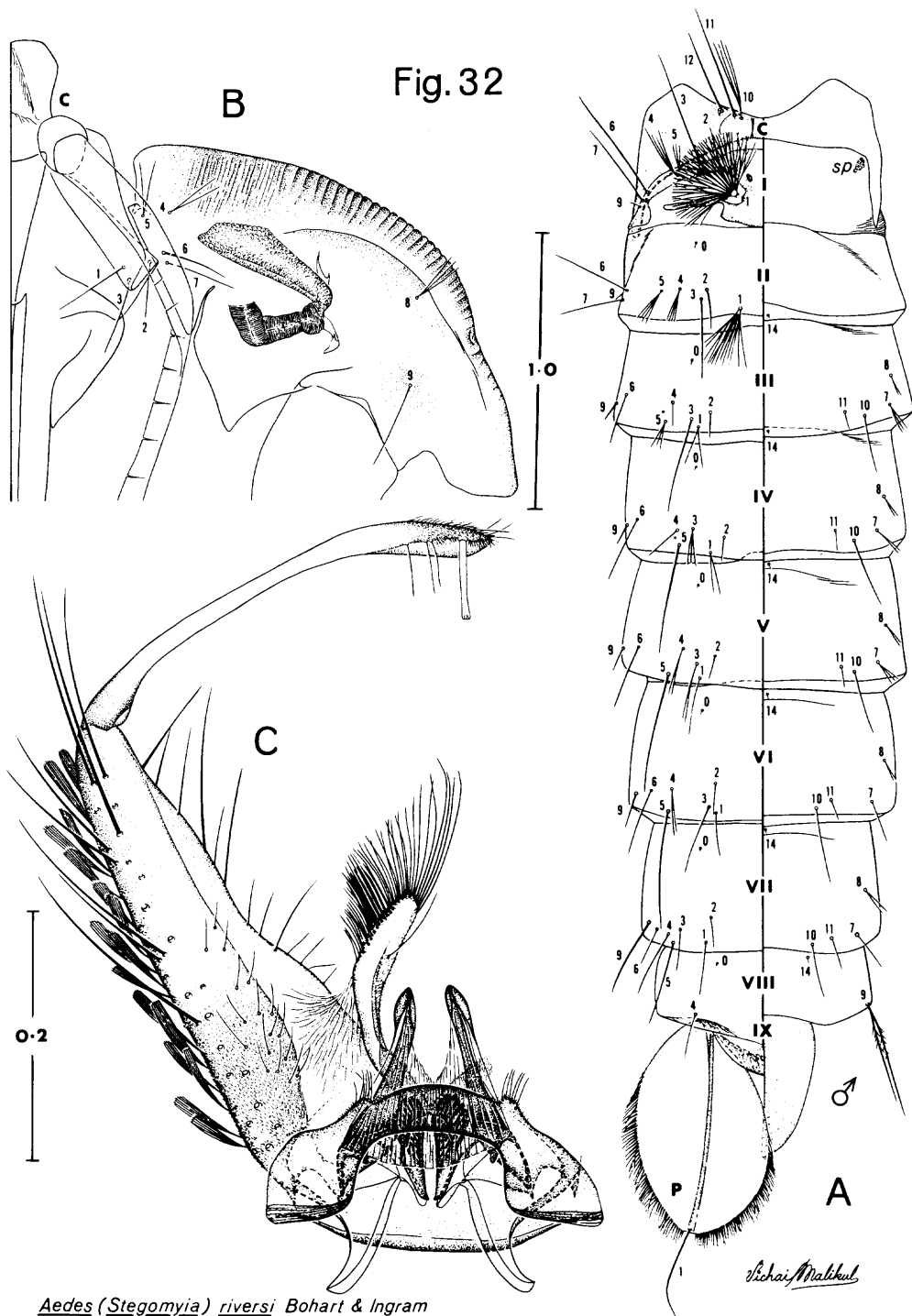
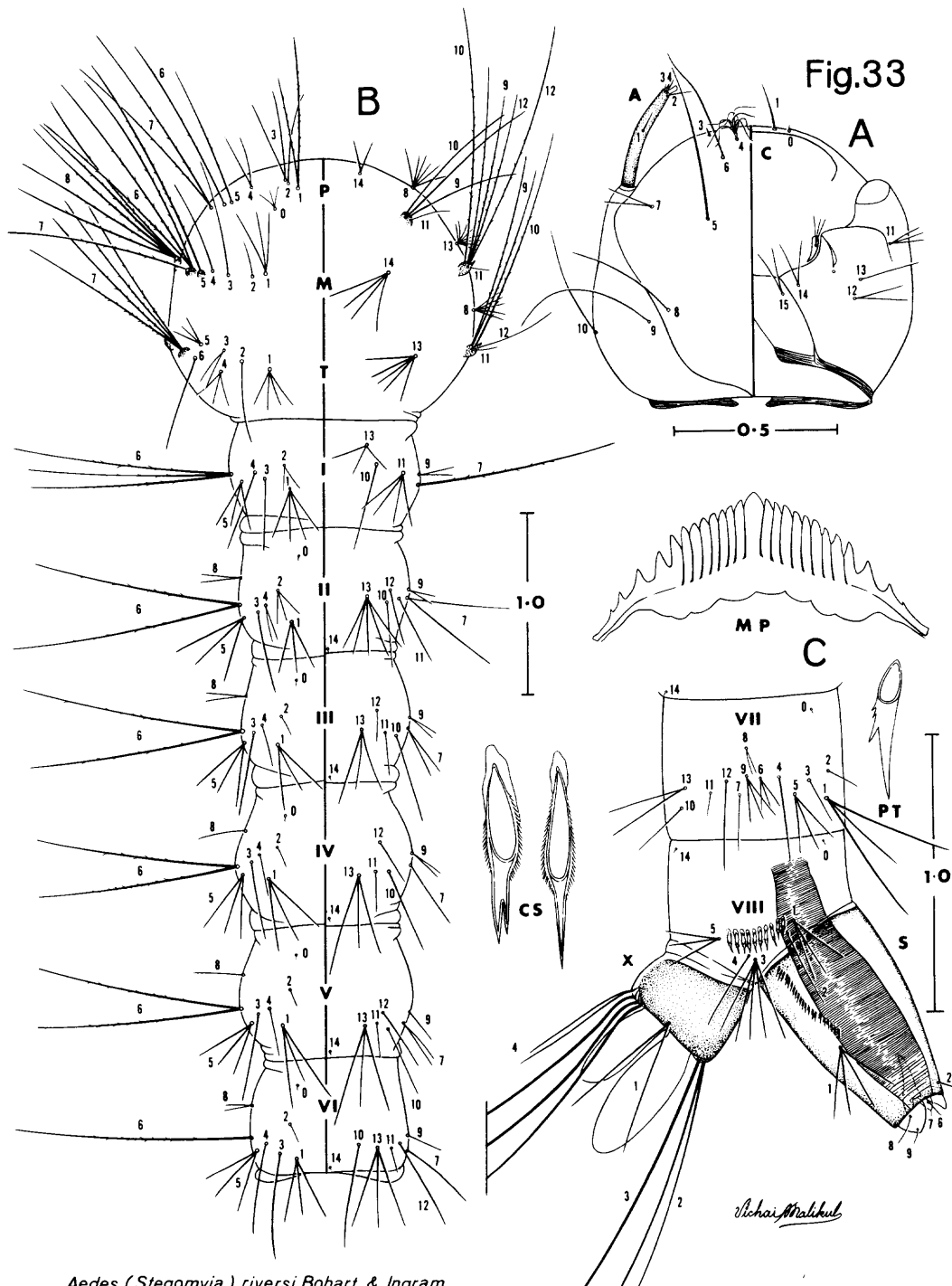


Fig. 31

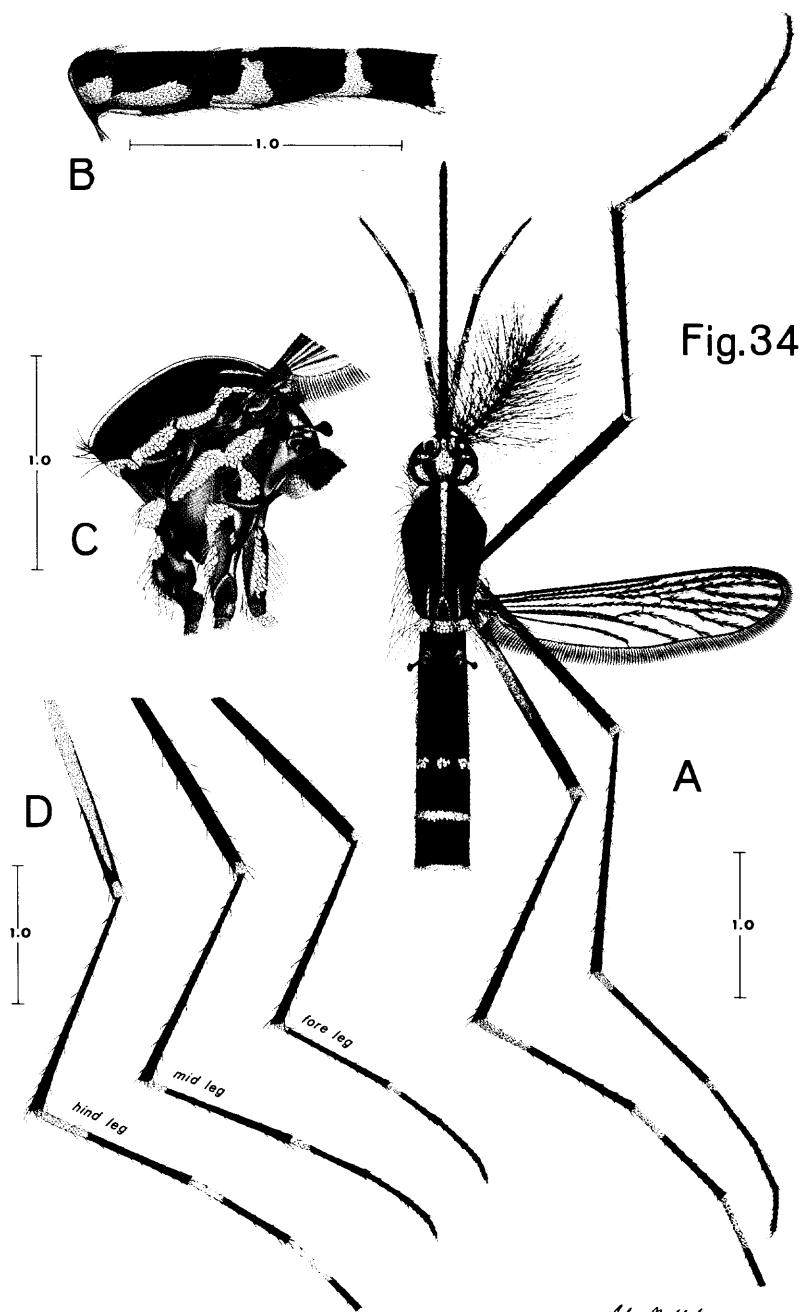




*Aedes (Stegomyia) riversi* Bohart & Ingram

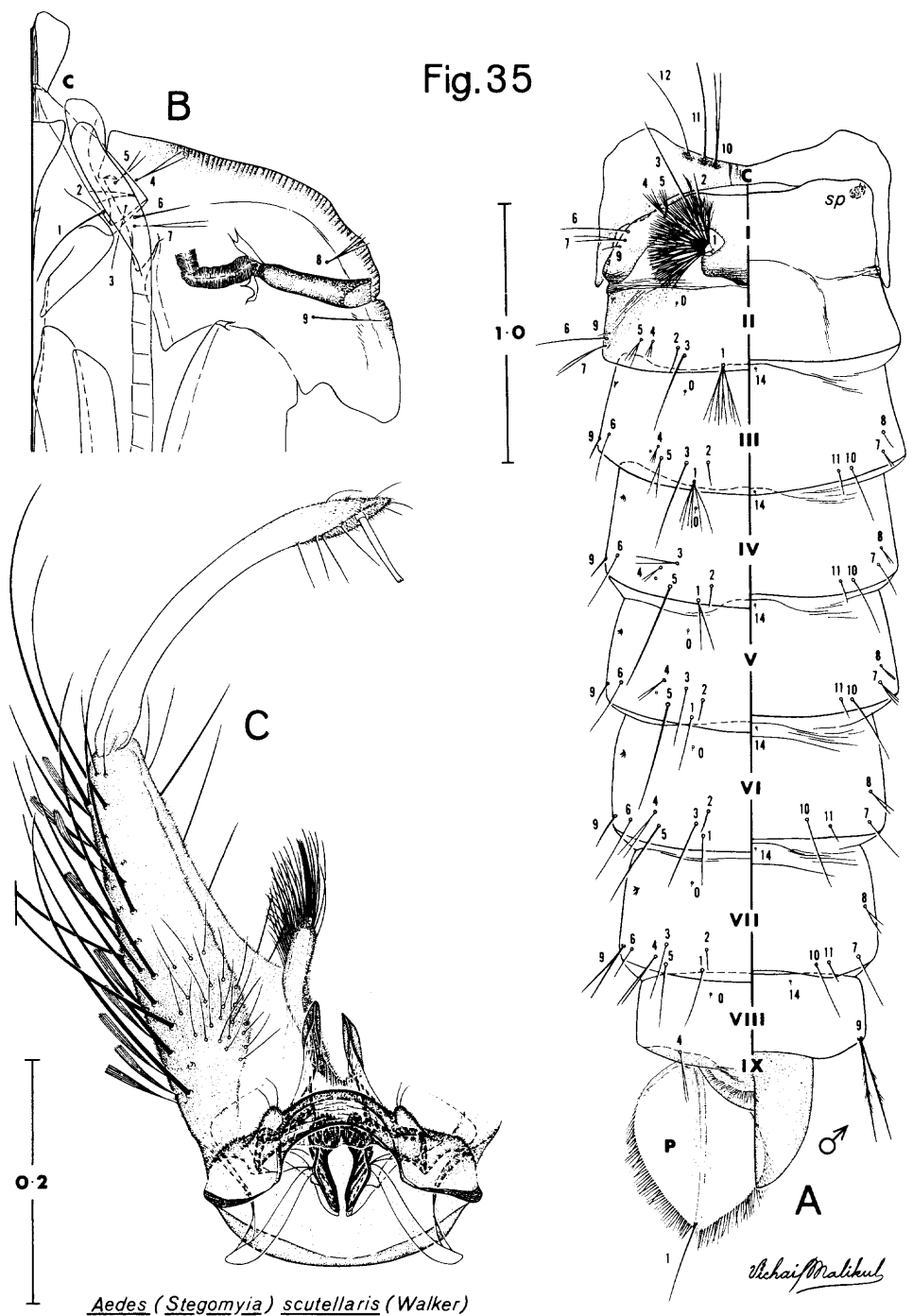


*Aedes (Stegomyia) riversi* Bohart & Ingram



Topotypic male (Aroe Islands)  
*Aedes (Stegomyia) scutellaris* (Walker)

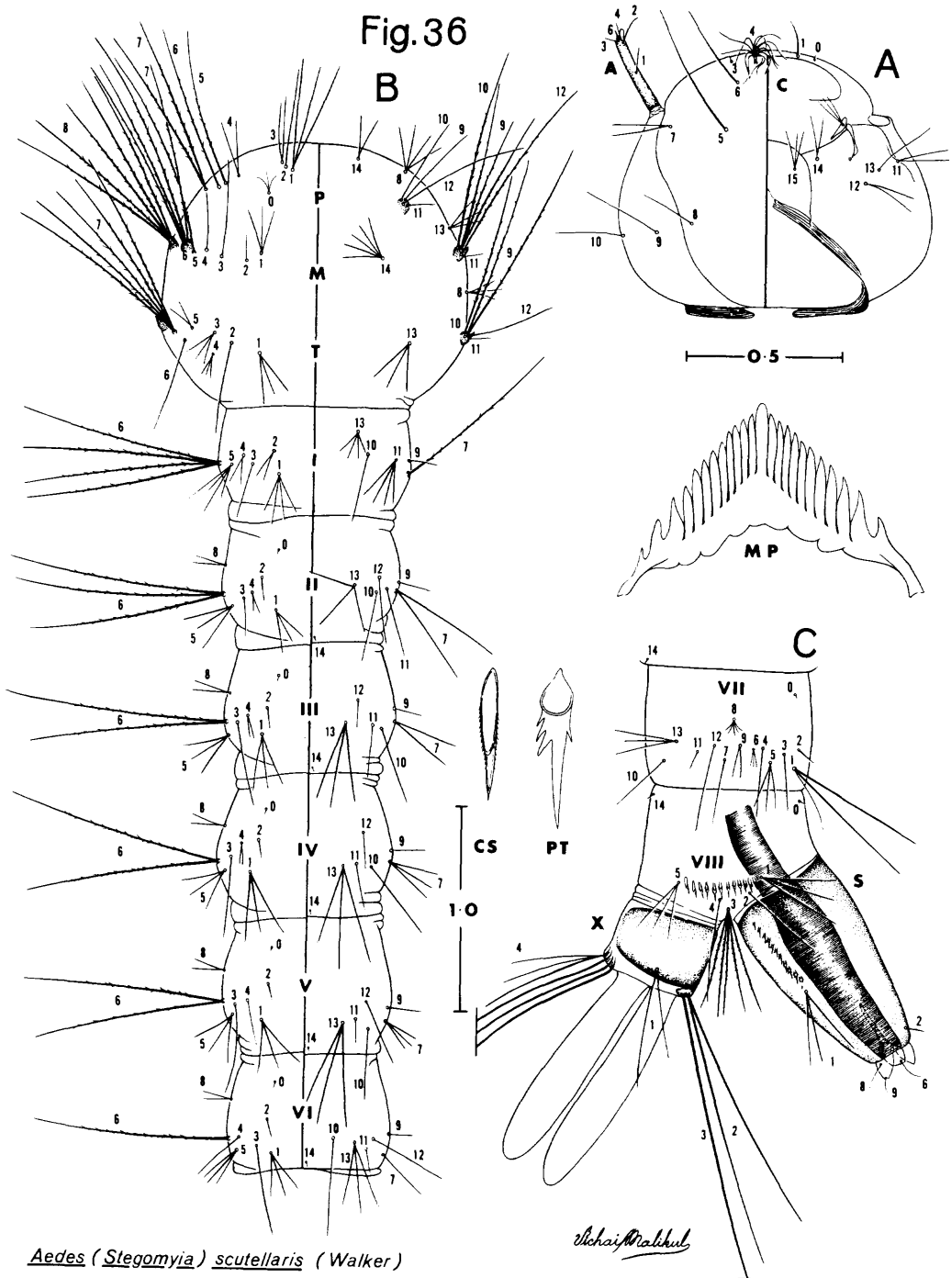
Fig.35



*Aedes (Stegomyia) scutellaris* (Walker)

Richai Matikul

Fig. 36



*Aedes (Stegomyia) scutellaris* (Walker)



## INDEX

Names of valid taxa are in roman type; synonyms are in italic type. Italic numerals refer to the principal text references. Roman numerals refer to secondary text references; the suffix "k" indicates mentioning in a key and the suffix "t" in a table. Roman numerals in parentheses without a suffix refer to the figures and with the suffix "m" to a map.

|                         |  |
|-------------------------|--|
| aegypti (Linnaeus)      | 17, 34   |
| albolineatus (Theobald) | 4  |
| albolineatus group      | 4  |
| albopictus (Skuse)      | 2, 4, 5, 6k, 8k, 11k, 12k, 13, 14, 16, 17, 18t, 20, 21, 22, 23, 31, 34, 37, 40, 48, 49, 55, 58, 67t, 68t (1, 2, 3, 2m) |
| albopictus subgroup     | 4, 5, 16, 20, 23, 26, 28, 31, 34, 36, 39, 67t, 68t   |
| alcasidi n. sp.         | 5, 7k, 9k, 11k, 12k, 16, 31, 37, 39, 40, 44, 47, 48, 51, 52, 54, 55, 58, 59t, 67t, 68t (21, 22, 23, 26)                |
| alorensis Bonne-Wepster | 5, 7k, 8k, 41, 42, 51, 67t, 68t (20, 24)   |
| andrewsi Edwards        | 5, 7k, 9k, 42, 43, 58, 67t, 68t (20, 24)   |
| Armigeres               | 34   |
| downsi Bohart & Ingram  | 4, 5, 6k, 8k, 10k, 12k, 16, 17, 19, 20, 21, 23, 25, 28, 31, 34, 36, 55, 67t, 68t (4, 5, 8, 20)                         |
| flavopictus Yamada      | 3, 4, 7k, 8k, 10k, 11k, 20, 21, 22, 23, 25, 28, 31, 34 (6, 7, 8, 20)   |
| hensilli Farner         | 3, 5, 7k, 9k, 40, 43, 44, 45, 48, 54, 55, 58, 59t (25, 31)   |
| lamberti Ventrillon     | 13   |
| malayensis Colless      | 5, 7k, 9k, 11k, 12k, 16, 31, 40, 44, 45, 46, 47, 48, 49, 51, 52, 54, 55, 58, 59t, 67t, 68t (26, 27, 28, 31)            |
| mediopunctatus subgroup | 4  |
| nigritia Ludlow         | 13   |
| novalbopictus Barraud   | 4, 6k, 7, 8k, 10k, 12k, 20, 23, 24, 25, 26, 36, 67t, 68t (8, 9, 10, 20)  |
| patriciae Mattingly     | 4, 7k, 8k, 11k, 12k, 20, 23, 25, 26, 27, 28, 31, 36, 67t, 68t (11, 12, 20)   |
| paullusi Stone & Farner | 5, 7k, 9k, 10k, 12k, 41, 49, 50, 51, 52, 67t, 68t (20, 29, 30)   |
| polynesiensis Marks     | 17   |
| pseudalbopictus (Borel) | 4, 5, 7k, 9k, 11k, 16, 20, 28, 30, 31, 36, 37, 40, 48, 55, 58, 67t, 68t (13, 14, 20)                                   |
| quasinigritia Ludlow    | 13   |
| riversi Bohart & Ingram | 5, 7k, 10k, 11k, 12k, 16, 21, 40, 44, 47, 48, 51, 52, 54, 55, 58, 59t, 67t, 68t (26, 31, 32, 33)                       |
| samarensis Ludlow       | 13   |
| scutellaris (Walker)    | 2, 4, 5, 7k, 9k, 11k, 12k, 16, 18, 31, 40, 43, 44, 45, 47, 48, 51, 52, 54, 55, 57, 58, 59t (25, 31, 34, 35, 36)        |
| scutellaris group       | 1, 2, 4, 5, 6, 16, 67t, 69t  |
| scutellaris subgroup    | 4, 5, 16, 39, 42, 43, 45, 47, 51, 54, 58, 67t, 68t   |
| seatoi Huang            | 4, 5, 6k, 8k, 10k, 11k, 16, 20, 32, 33, 34, 67t, 68t (15, 16, 17)  |

|                       |  |
|-----------------------|--|
| Stegomyia             | 1, 4, 5, 6   |
| subalbopictus Barraud | 4, 7k, 8k, 10k, 12k, 16, 20, 23, 25,<br>28, 31, 35, 36, 37, 67t, 68t (18, 19,<br>20) |
| variegatus Doleschall | 55   |
| zonatipes Walker      | 55   |

